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MICROFACIES OF THE LOWER CARBONIFEROUS BANFF FORMATION AND RUNDLE GROUP, MONKMAN PASS MAP AREA, NORTHEASTERN BRITISH COLUMBIA

B.L. MAMET
E.W. BAMBER
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Preface

Investigations of well exposed Lower Carboniferous sedimentary rocks in the eastern Cordillera of northeastern British Columbia provide important geological information for use in exploration of correlative, petroleum-bearing strata in the adjacent subsurface to the east. This report describes the stratigraphic succession exposed in the Monkman Pass area, outlines regional facies changes and age relationships, illustrates the main carbonate rock types, and presents correlations with other parts of the eastern Cordillera and western Plains. Thirty-two genera and 49 species of microfossils are described and illustrated. The zonation of this microbiota is shown to be consistent with that previously established elsewhere in western North America.

Stratigraphic and taxonomic studies of this kind provide detailed data necessary for an understanding of the depositional and tectonic history of the Western Canada Sedimentary Basin, and thereby contribute to the estimation and definition of mineral and energy resources in Canada.

R.A. Price
Director General
Geological Survey of Canada

Préface

Des études effectuées sur un affleurement de roches sédimentaires datant du Carbonifère inférieur, et situé dans la partie est de la Cordillère, dans le nord-est de la Colombie-Britannique, fournissent des renseignements géologiques précieux aux fins de l'exploration des couches pétrolifères corrélatives dans la subsurface adjacente vers l'est. Le présent rapport décrit la stratigraphie des couches qui affleurent dans la région de la passe Monkman, trace les grandes lignes des transformations que le faciès de la région a connues ainsi que les relations chronologiques des éléments de ce faciès, illustre les principaux types de roche carbonatée et établit des corrélations avec d'autres parties de l'est de la Cordillère et des Plaines de l'Ouest. Trente-deux genres et 49 espèces de microfossiles sont décrits et illustrés. La zonation de ce microbiote correspond à celle d'autres endroits identifiés antérieurement dans la partie ouest de l'Amérique du Nord.

Les études stratigraphiques et taxonomiques de ce genre procurent des renseignements détaillés susceptibles de contribuer à une meilleure compréhension de l'évolution des dépôts et des mouvements tectoniques du bassin sédimentaire de l'Ouest du Canada et, ainsi, contribuent à l'évaluation et à la détermination des ressources minérales et énergétiques du Canada.

Le directeur général de la
Commission géologique du Canada
R.A. Price

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MICROFACIES OF THE LOWER CARBONIFEROUS BANFF FORMATION AND RUNDLE GROUP, MONKMAN PASS MAP AREA, NORTHEASTERN BRITISH COLUMBIA

Abstract

Middle Tournaisian to middle Viséan microfossils of foraminiferal zones "pre-7" to 12 occur throughout the area in peritidal to open marine facies of the Banff Formation and Rundle Group. Foraminifers and algae belonging to 32 genera and 49 species are described and illustrated. The following new taxa are named: *"Globoendothyra"*(?) *paratrachida* sp. nov., *Skippella deboltensis* sp. nov., and *Spinoendothyra spinosa crassitheca* subsp. nov. The microfauna of the Monkman Pass area is dominated by foraminifers typical of the North American foraminiferal realm, but also contains cosmopolitan elements allowing direct correlations with the standard Lower Carboniferous succession of Europe. Exceptionally well preserved microfacies, straddling the Tournaisian - Viséan boundary, have yielded abundant representatives of the widespread *Spinoendothyra* (upper Tournaisian) and *Dainella-Inflatoendothyra-Globoendothrya* (lower Viséan) faunas. The vertical distribution of worldwide biostratigraphic markers, within this gradational, uninterrupted faunal succession, matches that in coeval strata of Europe and the U.S.S.R.

Résumé

Dans toute la région, dans les zones "pre-7" à 12 de foraminifères, du faciès péritidal au faciès pélagique de la formation de Banff et du groupe de Rundle, on rencontre des microfossiles datant du Tournaisien moyen au Viséan moyen. On décrit et illustre des foraminifères et des algues appartenant à 32 genres et 49 espèces. Les nouveaux taxa sont les suivants: *"Globoendothyra"*(?) *paratrachida* sp. nov., *Skippella deboltensis* sp. nov., et *Spinoendothyra spinosa crassitheca* subsp. nov. La microfaune de la région de Monkman Pass est dominée par des foraminifères typiques du domaine nord-américain, mais contient aussi des éléments cosmopolites qui permettent des corrélations directes avec la succession européenne standard du Carbonifère inférieur. Des microfaciès exceptionnellement bien conservés, couvrant la limite entre le Tournaisien et le Viséen, ont fourni un grand nombre de représentants des faunes à *Spinoendothyra* (Tournaisien supérieur) et *Dainella-Inflatoendothyra-Globoendothyra* (Viséen inférieur). La distribution verticale d'indicateurs biostratigraphiques cosmopolites, à l'intérieur de cette succession faunique progressive et continue, est similaire à celle de strates contemporaines de l'Europe et de l'U.R.S.S.

INTRODUCTION

In the Rocky Mountains and Foothills of northeastern British Columbia, a broad, sinuous, northwest trending belt of thick, Lower Carboniferous, platform carbonates overlies and grades westward into a correlative belt of relatively thin, basinal shale and siltstone. The structural grain of the Eastern Cordillera cuts obliquely across these two lithofacies belts with the result that exposures of the basinal shale facies occur mainly in the more northerly areas (Bamber et al., 1980).

To the south, in the Monkman Pass area (Fig. 1), the western, basinal facies belt is not preserved, and Lower Carboniferous rocks younger than middle Viséan are absent, because of truncation beneath regional sub-Bashkirian and sub-Permian disconformities (Fig. 2; McGugan and Rapson-McGugan, 1976; Bamber and Macqueen, 1971, 1979; Bamber et al., 1980). The preserved succession, which includes shale and siltstone in its lower part, consists mainly of platform carbonates, including a large variety of rock types indicating deposition in environments ranging from shallow water, restricted and open shelf, to deeper water, platform slope. These rocks have yielded abundant, well preserved fossil assemblages ranging in age from middle Tournaisian to middle Viséan. In this paper, detailed biostratigraphic data are presented for the foraminifers and algae, and the major elements of this microbiota are illustrated and described. Of particular interest are well preserved microfacies that straddle the Tournaisian-Viséan boundary and are characterized by the cosmopolitan *Spinoendothyra* fauna.

The study is based on samples from six stratigraphic sections (figs. 1, 3). Descriptions and illustrations of microfacies, and the zonation of foraminifers and algae were prepared by B.L. Mamet. Fieldwork and lithostratigraphic studies, on which the stratigraphic framework (Fig. 3) is based, were carried out by E.W. Bamber and R.W. Macqueen. Specimens illustrated in plates 1 to 18 are stored in the type collection of the Geological Survey of Canada, in Ottawa.

Acknowledgments

The writers wish to acknowledge the helpful comments given by T.R. Marchant, who critically read the manuscript. Fieldwork was done in conjunction with Geological Survey of Canada field parties under the leadership of G.C. Taylor and R.I. Thompson. B.C. Richards kindly provided recent field data necessary for the interpretation of facies relationships (Fig. 3) and revision of previously established stratigraphic nomenclature (see Bamber et al., 1980).

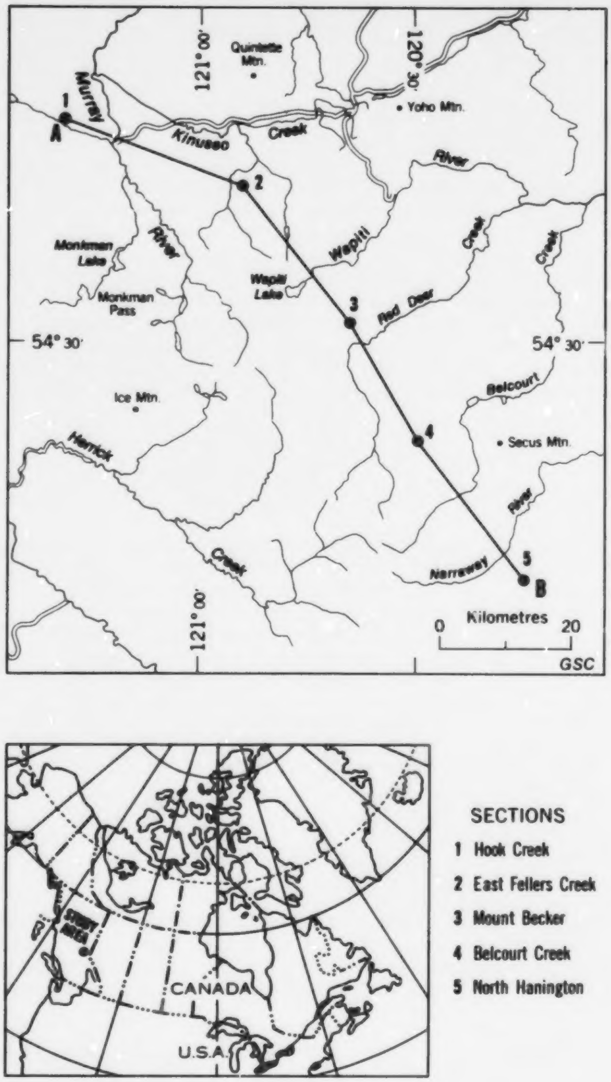


Figure 1. *Index map.*

STRATIGRAPHY

The Lower Carboniferous succession in the Monkman Pass area outcrops in a narrow, northwest-trending belt within the Rocky Mountain Front Ranges (Fig. 1; Taylor and Stott, 1979). It consists of lower and middle Tournaisian shale, siltstone, and argillaceous carbonates (Exshaw and Banff formations) overlain by upper Tournaisian to middle Viséan peritidal to open marine carbonates of the Rundle Group (figs. 2, 3).

The succession within the Rundle Group is similar to that in the Front Ranges and Foothills of the Banff-Jasper area of Alberta (eastern facies of Macqueen and Bamber, 1967). Open marine, echinoderm lime grainstone and lime packstone of the middle and upper Tournaisian Pekisko Formation are overlain by open to restricted shelf carbonates of the upper Tournaisian Shunda Formation. The latter contains a diversity of shallow water carbonate types ranging from echinoderm lime packstone to microdolomite. Algae are abundant, and fenestral fabric is well developed locally.

In the central and southern part of the area, the upper Shunda carbonates pass westward into an unnamed unit of lime packstone, crossbedded echinoderm grainstone, and dolomite. The grainstone intervals appear to be eastward thinning tongues of a thicker succession of dolomitized lime grainstone. The latter outcrops immediately north of Jarvis Lakes (Fig. 1), where it is underlain by a very thin interval of shallow shelf carbonates assignable to the Shunda Formation. The Shunda Formation and the Unnamed unit are overlain by echinoderm lime grainstone (and dolomitized equivalents) of the lower Viséan Turner Valley Formation, which occurs as a distinctive, light grey weathering cliff-former at most localities (B.C. Richards, pers. comm., 1981). Throughout the area, the Turner Valley Formation is overlain by lower and middle Viséan, open to restricted, shelf carbonates of the Mount Head(?) Formation, which is a heterogeneous, cyclic succession of cherty, algal and echinoderm lime wackestone, lime packstone, and dolomitized echinoderm lime grainstone. It is locally rich in plants and contains minor shale beds (B.C. Richards, pers. comm., 1981). These rock types strongly resemble the coeval carbonates of the Mount Head Formation in southern Alberta, but detailed lateral relationships between the two areas have not been established at this stratigraphic level.

BIOSTRATIGRAPHY

Abundant, well preserved, Lower Carboniferous foraminifers and algae of the Monkman Pass area are assigned to middle Tournaisian to middle Viséan foraminiferal zones "pre-7" to 12, previously established for the North American Cordillera (Mamet and Skipp, 1970; Mamet, 1976). The ages and major taxonomic elements of the these 7 zones (figs. 2, 4) are discussed below.

Tournaisian foraminiferal assemblages below Zone 7, assigned to Zone "pre-7", are very poorly developed in the unfavourable microfacies at this level in the Canadian Cordillera (Mamet, 1976, p. 10). In the Monkman Pass area, there is insufficient microfauna in the terrigenous clastics and impure carbonates of the lower and middle Banff Formation for definite recognition of the middle Tournaisian "pre-7" assemblage. The widespread "*Earlandia minima* facies" yields only minute Earlandiidae from this interval, and the Tournayellidae and Endothyridae are conspicously absent. In more northerly outcrop and subsurface sections of northeastern British Columbia, a similar situation exists, but there the Banff Formation has yielded a sparse fauna of latiendothyrids, septabrunsiids, and septaglomospiranellids (Bamber and Mamet, 1978, p. 10, 15).

Zone 7 is middle Tournaisian in age and is recognized in the Monkman Pass area by the presence of ***Chernyshinella***, ***Palaeospiroplectammina tchernyshinensis***, and ***Rectoseptaglomospiranella nalivkini*** (Mamet, 1976, p. 78, 79). In addition, the alga ***Asphaltinella*** is very abundant and forms bafflestone at the top of the zone. The distribution of

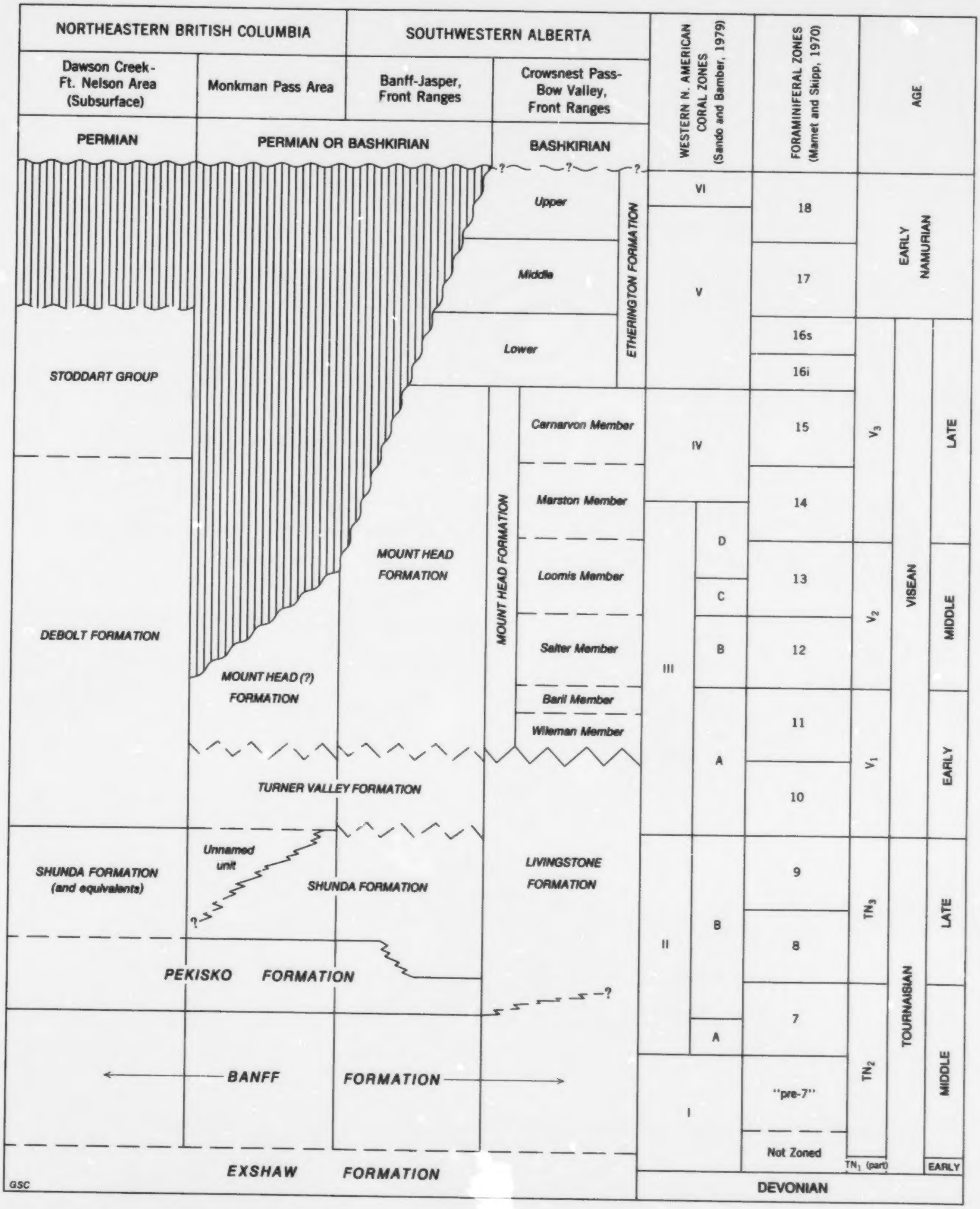

NORTHEASTERN BRITISH COLUMBIA
SOUTHWESTERN ALBERTA
Dawson Creek-Ft. Nelson Area (Subsurface)
Monkman Pass Area
Banff-Jasper, Front Ranges
Crowsnest Pass-Bow Valley, Front Ranges
WESTERN N. AMERICAN CORAL ZONES (Sando and Bamber, 1979)
FORAMINIFERAL ZONES (Mamet and Skipp, 1970)
AGE
PERMIAN
PERMIAN OR BASHKIRIAN
BASHKIRIAN
?
Upper
Middle
Lower
ETHERINGTON FORMATION
STODDART GROUP
DEBOLT FORMATION
MOUNT HEAD FORMATION
MOUNT HEAD (?) FORMATION
MOUNT HEAD FORMATION
Carnarvon Member
Marston Member
Loomis Member
Salter Member
Baril Member
Wileman Member
TURNER VALLEY FORMATION
SHUNDA FORMATION (and equivalents)
Unnamed unit
SHUNDA FORMATION
LIVINGSTONE FORMATION
PEKISKO FORMATION
BANFF FORMATION
EXSHAW FORMATION
GSC
VI
V
IV
III
D
C
B
A
II
B
A
I
18
17
16s
16i
15
14
13
12
11
10
9
8
7
"pre-7"
Not Zoned
EARLY NAMURIAN
V_3
V_2
V_1
TN_3
TN_2
TN_1 (part)
VISEAN
TOURNAISIAN
LATE
MIDDLE
EARLY
LATE
MIDDLE
EARLY
DEVONIAN

Figure 2. *Correlation of Lower Carboniferous formations, southwestern Alberta and northeastern British Columbia.*

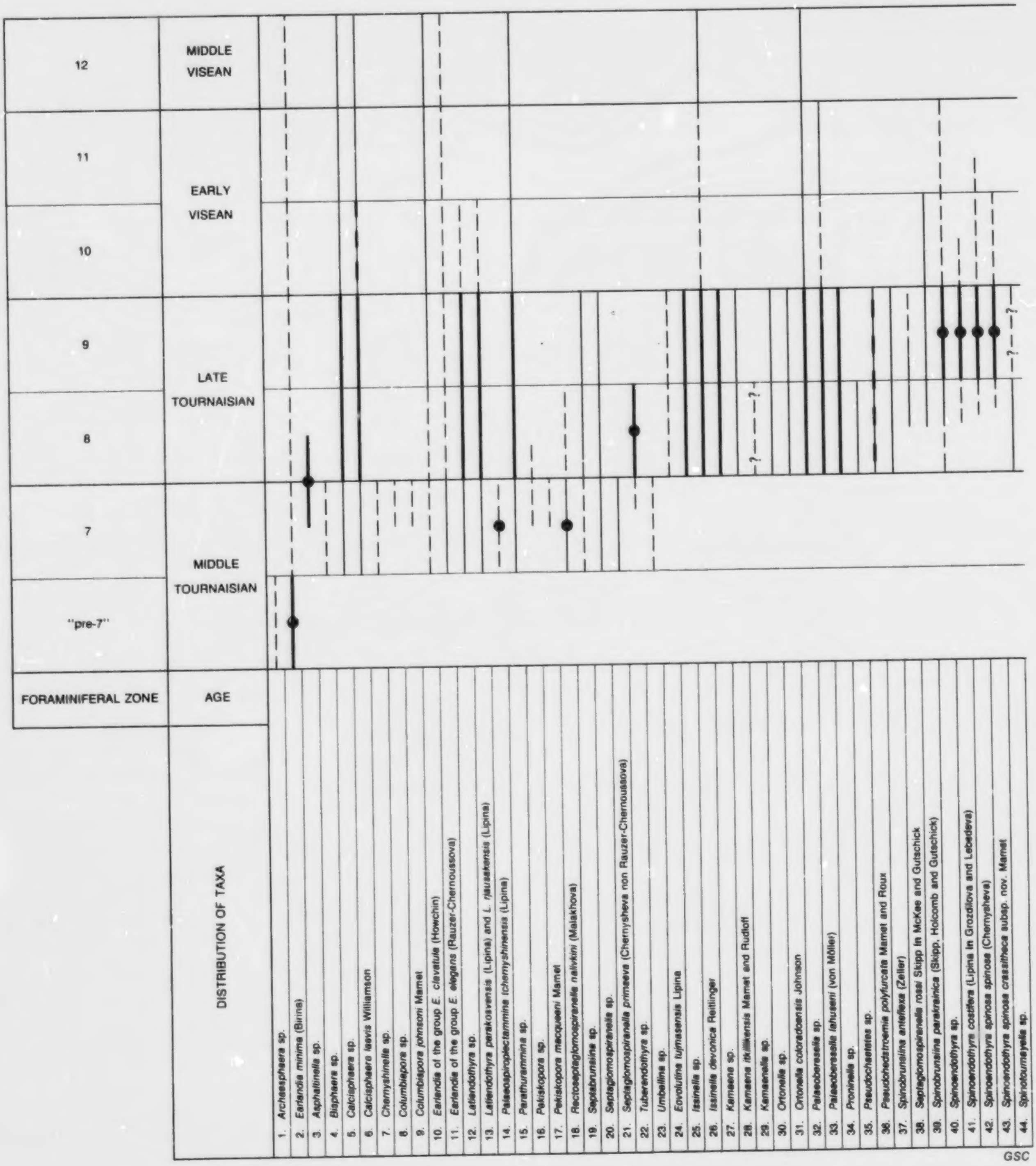
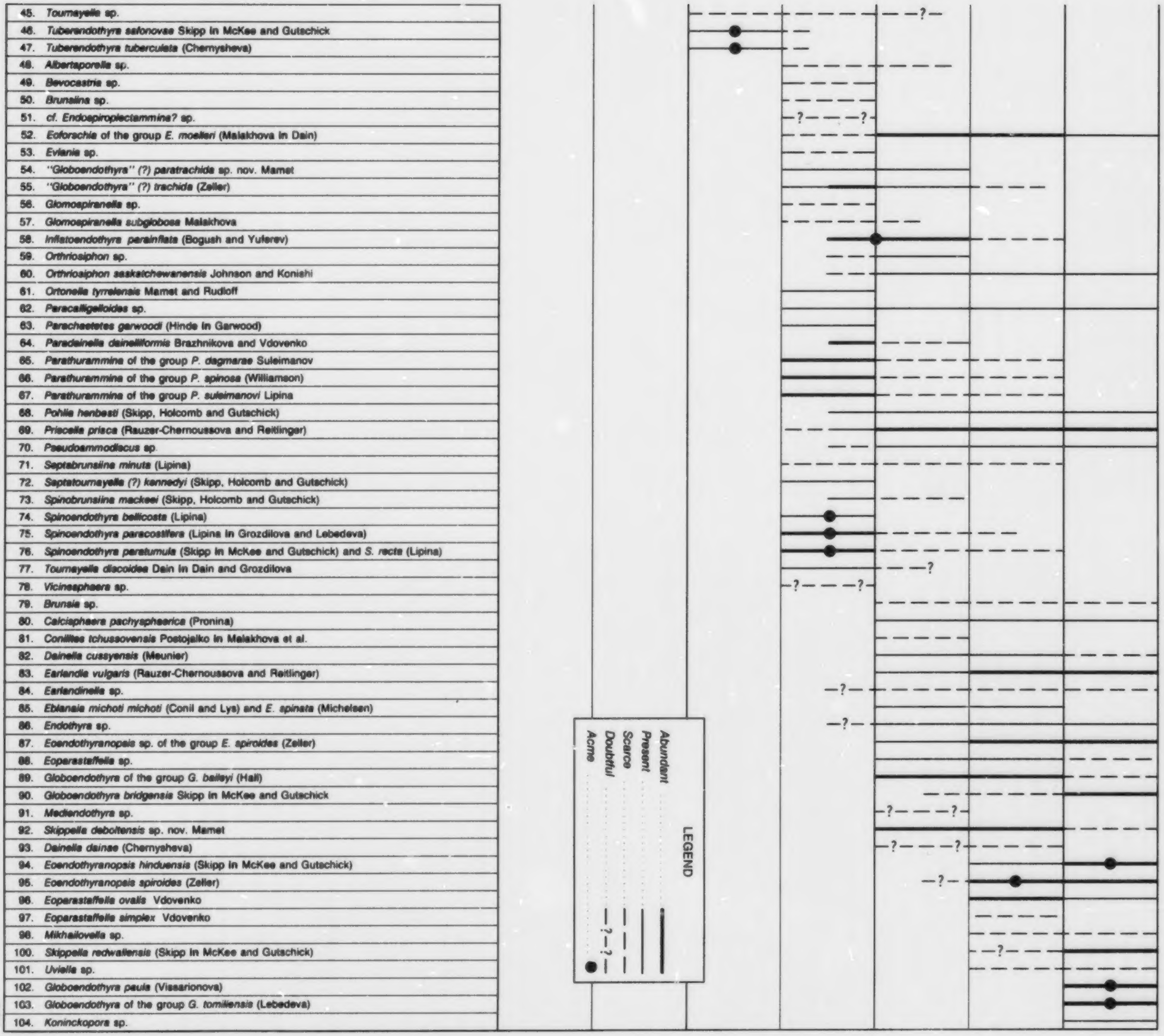


Figure 4. Zonal distribution of major elements of Lower Carboniferous microbiota, Monkman Pass area.


45. Tournayella sp.
46. Tuberendothyra safonovae Skipp in McKee and Gutschick
47. Tuberendothyra tuberculata (Chernysheva)
48. Albertaporella sp.
49. Bevocastria sp.
50. Brunsiina sp.
51. cf. Endospiroplectammina? sp.
52. Eoforschia of the group E. moelleri (Malakhova in Dain)
53. Evlania sp.
54. "Globoendothyra" (?) paratrachida sp. nov. Mamet
55. "Globoendothyra" (?) trachida (Zeller)
56. Glomospiranella sp.
57. Glomospiranella subglobosa Malakhova
58. Inflatoendothyra parainflata (Bogush and Yuferev)
59. Orthriosiphon sp.
60. Orthriosiphon saskatchewanensis Johnson and Konishi
61. Ortonella tyrrelensis Mamet and Rudloff
62. Paracalligelloides sp.
63. Parachaetetes garwoodi (Hinde in Garwood)
64. Paradainella dainelliformis Brazhnikova and Vdovenko
65. Parathurammina of the group P. dagmarae Suleimanov
66. Parathurammina of the group P. spinosa (Williamson)
67. Parathurammina of the group P. suleimanovi Lipina
68. Pohlia henbesti (Skipp, Holcomb and Gutschick)
69. Priscella prisca (Rauzer-Chernoussova and Reitlinger)
70. Pseudoammodiscus sp.
71. Septabrunsiina minuta (Lipina)
72. Septatournayella (?) kennedyi (Skipp, Holcomb and Gutschick)
73. Spinobrunsiina mackeei (Skipp, Holcomb and Gutschick)
74. Spinoendothyra bellicosta (Lipina)
75. Spinoendothyra paracostifera (Lipina in Grozdilova and Lebedeva)
76. Spinoendothyra paratumula (Skipp in McKee and Gutschick) and S. recta (Lipina)
77. Tournayella discoidea Dain in Dain and Grozdilova
78. Vicinesphaera sp.
79. Brunsia sp.
80. Calcisphaera pachysphaerica (Pronina)
81. Conilites tchussovensis Postojalko in Malakhova et al.
82. Dainella cussyensis (Meunier)
83. Earlandia vulgaris (Rauzer-Chernoussova and Reitlinger)
84. Earlandinella sp.
85. Eblanaia michoti michoti (Conil and Lys) and E. spinata (Michelsen)
86. Endothyra sp.
87. Eoendothyranopsis sp. of the group E. spiroides (Zeller)
88. Eoparastaffella sp.
89. Globoendothyra of the group G. baileyi (Hall)
90. Globoendothyra bridgensis Skipp in McKee and Gutschick
91. Mediendothyra sp.
92. Skippella deboltensis sp. nov. Mamet
93. Dainella dainae (Chernysheva)
94. Eoendothyranopsis hinduensis (Skipp in McKee and Gutschick)
95. Eoendothyranopsis spiroides (Zeller)
96. Eoparastaffella ovalis Vdovenko
97. Eoparastaffella simplex Vdovenko
98. Mikhailovella sp.
100. Skippella redwallensis (Skipp in McKee and Gutschick)
101. Uviella sp.
102. Globoendothyra paula (Vissarionova)
103. Globoendothyra of the group G. tomiliensis (Lebedeva)
104. Koninckopora sp.
LEGEND
Abundant
Present
Scarce
Doubtful —?—?—
Acme
?
GSC

the dasycladaceans *Columbiapora* and *Pekiskopora* appears to be quite erratic. This zone has the same composition farther north in northeastern British Columbia (Bamber and Mamet, 1978, p. 10, 15).

Zone 8 is early late Tournaisian in age and is rich in Endothyridae and Tournayellidae; *Tuberendothyra tuberculata* and *Tuberendothyra safonovae*, associated with *Spinobrunsiina*, are characteristic of the level. Numerous representatives of *Asphaltinella* are present at the base, but are replaced higher in the zone by *Issinella-Palaeoberesella-Proninella* bafflestone. Abundant codiacean algae (*Ortonella*, *Pseudohedstroemia*) are encountered in the quieter lagoonal facies. Tuberendothyrids characterize this zone in more northerly sections of northeastern British Columbia as well (Bamber and Mamet, 1978, p. 10, 15), but they are associated with *Septaglomospiranella dainae* in that area. *S. dainae* is virtually absent from the Monkman Pass area, where spinose tournayellids (*Spinobrunsiina*) dominate the foraminiferal fauna.

The latest Tournaisian Zone 9 contains the acme of *Spinoendothyra* in this area, with an exceptional abundance of *Spinoendothyra bellicosta*, *S. costifera*, *S. paracostifera*, *S. paratumula*, *S. recta*, *S. spinosa spinosa*, and *S. spinosa crassitheca* subsp. nov. The zone contains the first occurrence of *Eoforschia*, *Inflatoendothyra*, *Paradainella*, and *Priscella*, and also has yielded the oldest known representatives of the genus *Pohlia*. A fauna similar to this is present farther north in northeastern British Columbia (Bamber and Mamet, 1978, p. 11, 15), but it also contains carbonellids and tetrataxids, which are unknown in the Monkman Pass area.

Zone 10, of earliest Viséan age, contains the first occurrence of *Globoendothyra*, *Dainella*, and *Eoparastaffella*, three world-wide markers of the zone. In addition, Conilites and *Eblanaia*, two recently described foraminifers from Europe, are here recorded for the first time in North America. Their presence confirms the stratigraphic reliability of the globoendothyrid-pseudoendothyrid phylogenies. The age of *Eblanaia* in the Monkman Pass area is early Viséan, which is in agreement with its apparent range in Europe. The new species *Skippella fellersi* is described from this level.

The late early Viséan Zone 11 is characterized by the elimination of most relict Tournaisian spinoendothyrids and their replacement by *Eoparastaffella* and *Eoendothyranopsis*. A similar change in the foraminiferal fauna takes place in sections studied farther to the north in northeastern British Columbia (Bamber and Mamet, 1978, p. 11, 15). In these northern sections, however, the algal microflora contains abundant Stacheiinae (*Mametella*, *Stacheia*, *Stacheoides*), whereas not a single representative of this group has been found in our Monkman Pass sections.

Zone 12, of early middle Viséan age, has abundant *Eoendothyranopsis* of the group *E. spiroides* (*E. spiroides* and *E. hinduensis*) associated with *Globoendothyra* of the group *G. tomiliensis*. These occur in abundance one zone lower than in the northern sections described by Bamber and Mamet (1978), and apparently no representatives of the Palaeotextulariidae occur in the Monkman Pass area. The algae are mostly Dasycladaceae, such as *Koninckopora*.

The distribution of zones "pre-7" to 12 through the Monkman Pass succession is shown in figures 2 and 3. Zone "pre-7" is poorly developed in the lower Banff Formation (Fig. 3, loc. 3). Zone 7 straddles the Banff-Pekisko boundary, as it does in the eastern facies of Bamber and Macqueen (1967) in southwestern Alberta, thus supporting correlations with that area (Fig. 2). Microfacies of lower Zone 8 are widespread in the upper Pekisko Formation. The upper part of Zone 8 and Zone 9 are well developed in the Shunda Formation. Earliest Viséan microfacies of Zone 10 occur in the Turner Valley Formation and locally in the lower Mount Head(?) Formation. The lower and middle Mount Head(?) Formation contains abundant, well preserved foraminifers and algae of zones 11 and 12 in the central and northern parts of the area, but microfossils are rare in the equivalent cherty dolomite to the southeast (Fig. 3). The dolomite of the upper Mount Head(?) Formation has yielded no diagnostic foraminifers or algae. Viséan microfacies younger than middle Viséan are absent from the Monkman Pass area because of late Paleozoic erosional truncation (Fig. 3).

Carbonate microfacies straddling the Tournaisian-Viséan boundary (zones 9, 10) are well preserved in central and northern sections of the Shunda and Turner Valley formations, and locally, in the Unnamed unit (locs. 1, 2, 3; figs. 1, 3). The carbonates at this level have not been extensively dolomitized or recrystallized, and consequently the diverse foraminiferal and algal assemblages that they contain are exceptionally well preserved. Moreover, there is no abrupt facies change across the boundary between zones 9 and 10, which coincides approximately with the gradational Shunda-Turner Valley contact (Fig. 3). Therefore, changes in the composition of the foraminiferal fauna across this boundary are unlikely to have been caused by facies variation and probably represent continuous evolutionary sequences.

The Monkman Pass fauna, which belongs to the North American foraminiferal realm (Mamet, 1976, p. 8), consists mainly of Endothyridae and Tournayellidae in the upper Tournaisian, and of Endothyridae and Globoendothyridae in the lower Viséan. Forschiids and pseudoendothyrids are less abundant. Some elements of the fauna are cosmopolitan – for example, the late Tournaisian (Zone 9) *Spinoendothyra* fauna, which is virtually identical with the *Spinoendothyra* assemblage from the Urals described by Lipina (1955), and the early Viséan (Zone 10) *Dainella-Inflatoendothyra-Globoendothyra* fauna. Such rapidly evolving, abundant, cosmopolitan faunas are obviously highly useful for biostratigraphic correlations. It is noteworthy that Zone 10 contains the first reported North American occurrence of the early Viséan *Eblanaia* fauna, which appears to have the same age in British Columbia as in Ireland, Denmark, and Belgium.

Other elements of the fauna appear to be restricted to North America. For instance, among the Tournayellidae, *Septaglomospiranella rossi*, *Septatournayella*(?) *kennedyi*, *Spinobrunsiina anteflexa*, *S. parakrainica*, and *S. mackeei* are all North American species allowing correlations along the carbonate platform margin of western United States and Canada. It also must be emphasized that the Monkman Pass fauna, in common with other faunas of the North American realm, is devoid of many elements characteristic of the Tethyan realm. This is well illustrated by the Archaediscidae and Eostaffellidae; not a single representative of *Permodiscus* (in the original Russian sense), *Propermodiscus*, *Viseidiscus*, *Archaediscus*, or *Eostaffella* has been encountered, although they are important early Viséan markers in Eurasia. Lituotubellids are also absent, and the Tetrataxidae are poorly represented. Thus, although there are enough cosmopolitan elements present to permit direct biostratigraphic correlations with the European chronostratigraphic standard, the Monkman Pass fauna, as a whole, belongs to the impoverished North American realm.

A diverse macrofauna is associated with the foraminifers and algae discussed above. Two of the western North American coral zones of Sando and Bamber (1979) are abundantly represented (Fig. 2). Zone IIB, typified by the presence of *Sychnoelasma* and *Aulostylus*, is represented in the uppermost Banff Formation and in the Pekisko and Shunda formations. This interval includes middle and upper Tournaisian foraminiferal zones 7 (upper), 8, and 9. Abundant representatives of coral Zone IIIA occur throughout the overlying Turner Valley and Mount Head(?) formations. This zone, which is characterized by the presence of *Ankhelasma*, *Zaphriphyllum*, and *Lithostrotion* (*Siphonodendron*) *oculinum* Sando, spans lower Viséan foraminiferal zones 10 and 11.

A varied assemblage of middle Tournaisian brachiopods has been identified by J.L. Carter (pers. comm., 1974) from the upper Banff Formation (foraminiferal Zone 7) at several sections (locs. 1, 2, 3, 4; Fig. 3). Lower Viséan ammonoids, including the genera *Pericyclus*, *Muensteroceras*, *Beyrichoceratoides*, and *Merocanites* (W.W. Nassichuk, pers. comm., 1981), occur within foraminiferal Zone 11 in the lower Mount Head(?) Formation at Locality 4 (Fig. 3) and at several other of the more southerly outcrops not included in measured sections. Faunal lists, including identifications of brachiopods, corals, echinoderms, and other invertebrate fossils found in the succession, have been published by Laudon et al. (1949), Sutherland (1958), and McGugan and Rapson-McGugan (1976).

SYSTEMATIC PALEONTOLOGY

B.L. Mamet

Phylum PROTOZOA

Order FORAMINIFERIDA

Family EARLANDIIDAE Cummings, 1955

Genus *Earlandia* Plummer, 1930

Earlandia of the group *E. minima* (Birina, 1948)

Earlandia minima (Birina, 1948)

Plate 1, fig. 1

Hyperammina minima Birina, 1948, p. 155 and 159, Plate 2, figs. 7-8.

Hyperammina minima; Malakhova, 1954, p. 50, Plate 1, figs. 1?, 2.

Hyperammina minima; Lipina, 1955, p. 25, Plate 2, fig. 11.

Hyperammina minima; Golubtsov, 1957, p. 95-96, Plate 1, figs. 6-8.

Earlandia minima; Conil and Lys, 1964, p. 54, Plate 7, figs. 100-101.

Earlandia minima; Bogush and Yuferev, 1966, p. 83, Plate 1, fig. 17.

Earlandia minima; Aizenberg et al., 1968, no description, p. 13, Plate 2, fig. 20.

Earlandia minima; Platonov, 1969, p. 56, Plate 1, figs. 12-13.

Earlandia minima; Solovieva, 1969, no description, p. 12, Plate 1, fig. 44.

Earlandia minima; Bogush and Yuferev, 1970, p. 97, Plate 1, fig. 18.

(not) *Earlandia minima*; Brazhnikova and Vdovenko, 1971, no description, Plate 3, fig. 12.

Earlandia minima; Ivanova, 1973, no description, Plate 3, fig. 3.

Earlandia (*Earlandia*) *minima*; Braznikova and Vdovenko, 1973, p. 263, Plate 1, figs. 6-8.

Earlandia minima; Malakhova, 1975, p. 6, Plate 1, fig. 3.

(not) *Earlandia minima*; ("Golubtsov non Birina"); Sosnina and Nikitina, 1976, no description, Plate 1, figs. 4, 9, 10.

Earlandia of the group *E. minima*; Armstrong and Mamet, 1977, p. 24 (for definition of the group).

Earlandia of the group *E. minima*; Brenckle, 1977, no description, Plate 2, figs. 12, 13.

Earlandia minima; Rich, 1980, p. 15, Plate 1, fig. 16.

Diagnosis. Proloculus spherical (30 to 50 μm) followed by a straight, tubular, cylindrical chamber. Diameter approximately 30 μm (25 to 40 μm). Wall very thin, fragile, 5 μm or less. Aperture single, at open end of tube. Wall, an undifferentiated tectum.

Remarks. Other groups and species of *Earlandia* such as *E. elegans* (Rauzer-Chernoussova and Reitlinger, 1937), *Earlandia clavatula* (Howchin, 1888) and *Earlandia vulgaris* (Rauzer-Chernoussova and Reitlinger, 1937) are common in the Monkman Pass Carboniferous succession. As they have been profusely illustrated in the past, and as they have little stratigraphic significance, the reader is referred to Armstrong and Mamet, 1977, for further references and full taxonomic treatment.

Stratigraphic range and distribution. As with most species of *Earlandia*, *E. minima* is long ranging and of little stratigraphic interest. When abundant, however, it characterizes the "*Earlandia minima* facies", often observed in the basal middle Tournaisian. Such a facies is widespread at that level throughout Eurasia and North America. In Canada, it is commonly found in the lower part of the Banff Formation. In the Monkman Pass area, the taxon is widespread in the Banff Formation and occasionally observed in the Unnamed unit, and the Shunda, Turner Valley, and Mount Head(?) formations.

Family TOURNAYELLIDAE Dain, 1953 *non sensu*
Conil and Lys, 1977

Genus *Glomospiranella* Lipina in Dain, 1953

Glomospiranella subglobosa (Malakhova, 1956)

Plate 1, figs. 2, 3

Glomospira subglobosa Malakhova, 1956, p. 91-92, Plate 1, figs. 17, 18, Plate 3, fig. 15.

Glomospira ilimica Malakhova, 1956, p. 91, Plate 1, fig. 16.

?*Endothyra* sp. McKay and Green, 1963, no text, Plate 4, fig. 8.

Glomospiranella subglobosa; Lipina, 1965, p. 60, Plate 12, figs. 18-20.

(not) *Glomospiranella subglobosa*; Brazhnikova and Vdovenko, 1973, no description, Plate 5, fig. 12.

Glomospiranella of the group *G. subglobosa*; Mamet, 1976, no text, Plate 14, fig. 9.

Glomospiranella subglobosa; Conil and Lys, 1977, p. 21.

Glomospiranella subglobosa; Armstrong and Mamet, 1977, p. 44.

Diagnosis. Test free, subglobular, inflated, without umbilical depression. Proloculus 40-65 μm, followed by an erratic spirotheca. Early coils tight, followed by a rapid expansion. Adults of four and one-half to six whorls, 500 to 600 μm. Early coils unseptated. Pseudoseptation develops in the rapidly expanding part, with four to five poorly defined pseudochambers in the last whorl. No secondary deposits. Wall undifferentiated, very thin in the early coil, then rapidly thickening in the pseudoseptate part, reaching 20-25 μm in the last whorl. Aperture, a slit at base of apertural face.

Remarks. *G. subglobosa* is quite similar to *G. latispiralis* Lipina (1955), which has a somewhat thinner wall and an even less pronounced pseudoseptation.

Stratigraphic range and distribution. Originally described from the Lower Viséan Lunevka Formation. The specimen illustrated by McKay and Green is reported from the Pekisko Formation of the Moose Mountain section, Alberta, but probably came from the Shunda Formation (Zone 9, upper Tournaisian). In the Monkman Pass area, the species is present in the upper Tournaisian and lowest Viséan (Shunda and Turner Valley formations).

Genus *Tournayella* Dain, 1953

Tournayella discoidea Dain in Dain and Grozdilova 1953

Plate 1, figs. 4, 5

For synonymy, see Armstrong and Mamet, 1977, and add:

Tournayella (*Tournayella*) *discoidea* var. discoidea forma typica OBJ, twice infrasubspecific; Brazhnikova and Vdovenko, 1971, p. 142, no description, Plate 10, figs. 2, 3, 5, 7, 9-18.

?*Tournayella* (*Tournayella*) *discoidea* forma maxima OBJ, infrasubspecific; Brazhnikova and Vdovenko, 1971, p. 142, Plate 10, fig. 1.

(not) *Tournayella* (*Tournayella*) *discoidea* var. angusta OBJ, infrasubspecific; Brazhnikova and Vdovenko, 1971, p. 140, Plate 9, figs. 22, 23, 27, Plate 10, fig. 4.

Tournayella discoidea; Brenckle, 1973, p. 31, Plate 3, figs. 10-13, 14?, 15?.

(not) *Tournayella discoidea*; Malakhova, 1973, p. 14, Plate 1, fig. 7.

Tournayella (*Tournayella*) *discoidea* forma pseudochomata OBJ infrasubspecific; Brazhnikova and Vdovenko, 1973, no description, Plate 3, figs. 23, 24.

(not?) *Tournayella discoidea* forma maxima; Bozorgnia, 1973, p. 54-55, Plate 7, figs. 1, 2.

?*Tournayella discoidea*; Postojalko, 1975, no description, p. 114, Plate 1, fig. 9.

(not?) *Tournayella* (*Tournayella*) *discoidea* forma maxima OBJ, infrasubspecific; Marchant, 1975, no description, Plate 1, fig. 3.

Tournayella cf. *discoidea*; Marchant, 1975, no description, p. 452, Plate 1, fig. 4.

?*Tournayella* (*Tournayella*) *discoidea*; Conil 1977, no description, Plate 1, fig. 13.

(not) *Tournayella* (*Tournayella*) ex. gr. *discoidea*; Conil 1977, no description, Plate 2, fig. 14.

(not) *Tournayella* (*Tournayella*) *discoidea* forma maxima OBJ, infrasubspecific; Conil, 1977, no description, Plate 1, fig. 12.

Tournayella (*Tournayella*) *discoidea* (part); Conil and Lys, 1977, p. 17, Plate 1, fig. 4, 5 (not 6).

Diagnosis. Test free, discoidal, laterally compressed. Proloculus quite large, followed by a tubular, planispirally coiled second chamber. Faint pseudoseptation in third and fourth coil. Last coil can have one or two true septa. Diameter 300 to 450 μm for adults of four whorls. Width, 120 to 180 μm. Three to six pseudochambers in the last whorl. Wall moderately thick, undifferentiated, a dark tectum, 15 to 18 μm in the last chamber. No secondary deposits. Aperture, a low slit at base of apertural face.

Remarks. Our material is practically identical to that illustrated from the upper Tournaisian part of the Wachsmuth Limestone and Kayak Shale of Alaska (Armstrong and Mamet, 1977).

Stratigraphic range and distribution. Cosmopolitan, with numerous middle and late Tournaisian references from Eurasia. In the Monkman Pass area, *T. discoidea* is a common taxon in the upper Tournaisian (Zone 9) Shunda Formation. A single specimen (illustrated, Plate 1, fig. 5) has been encountered in the basal part of Zone 10 in the Turner Valley Formation.

Genus *Septaglomospiranella* Lipina, 1955

Septaglomospiranella rossi (Skipp in McKee and Gutschick, 1969)

Plate 1, figs. 6-8

Septaglomospiranella rossi Skipp in McKee and Gutschick, 1969, p. 223-224, Plate 17, figs. 10, 11.

Septaglomospiranella rossi; Armstrong and Mamet, 1977, p. 44-45.

Diagnosis. Test free, discoidal, with a tendency to evolution in the last coil. Proloculus large, 45-60 μm, followed by a tightly coiled erratic volution. Adult specimens have three whorls and diameters that range from 270 to 330 μm. Early coils pseudoseptate. Last coil has true, short, oblique septa. Six to seven chambers in the last volution. Wall thin, eight to twelve μm, an undifferentiated tectum. No secondary deposits. Aperture, a low slit.

Remarks. We do not include *P. anteflexa* Zeller (1957, Plate 82, figs. 8, 9) as a synonym of *S. rossi*, as suggested by Skipp.

Stratigraphic range and distribution. Most of our specimens come from the Zone 8/9 boundary, and the species is observed up to the basal Viséan (Shunda Formation). Skipp reports a similar range in Arizona.

Genus *Septatournayella* Lipina 1955

Septatournayella(?) *kennedyi* (Skipp, Holcomb and Gutschick, 1966)

Plate 1, fig. 9

Septatournayella kennedyi Skipp, Holcomb and Gutschick, 1966, p. 25, Plate 4, figs. 1-5.

Septatournayella(?) *kennedyi*; Mamet, 1976, no description, Plate 14, figs. 2-3.

Septatournayella(?) *kennedyi*; Armstrong and Mamet, 1977, p. 49.

Septatournayella (*Septatournayella*) *kennedyi*; Conil and Lys, 1977, p. 17-18.

Diagnosis. Test free, discoidal, compressed, evolute, with symmetrical umbilical depressions. Form ratio 1: 0.2 to 0.3. Proloculus spherical, 30-45 μm, followed by a planispiral, regular, tightly coiled spirotheca. Diameter for adult specimens of four and one half to five whorls, 400 to 500 μm. Progressive development of the septation; pseudosepta in the early coils, then obtuse, short to long, very oblique septa in the last coil, delimiting eight low chambers. Height of chambers 50 μm. Resorbed secondary deposits? Wall, an undifferentiated tectum, 15 μm in the last volution. Aperture, a basal low slit.

Remarks. Some questionable secondary deposits were observed in the original material. They are equally problematical in the material from the Shunda of Alberta and British Columbia. The wall thickness also appears to be highly variable and ranges from thin to moderately thick.

Stratigraphic range and distribution. Scarce. Originally reported from the Salem and the Salem Warsaw transition (Skipp et al., 1966). Illustrated from the upper Tournaisian Shunda Formation of Alberta (Mamet, 1976). In the Monkman Pass area, quite scarce in the upper Tournaisian Shunda Formation.

Genus *Septabrunsiina* Lipina, 1955, (not) Conil and Lys, 1977

Septabrunsiina minuta (Lipina, 1948)

Plate 1, fig. 11

Endothyra (?) *minuta* Lipina, 1948, p. 255-256, Plate 19, figs. 7-8.

(not) *Endothyra minuta*; Reitlinger, 1950 (invalid), p. 32-33, Plate 5, figs. 7, 13.

Tournayella minuta; Dain in Dain and Grozdilova, 1953, p. 35-36, Plate 4, fig. 3.

(not) *Endothyra* (?) *minuta*; Grozdilova and Lebedeva, 1954, p. 89-90, Plate 11, fig. 1.

Endothyra pseudominuta Lipina 1955, p. 56-57, Plate 6, figs. 11-13.

Septatournayella (?) *minuta* Lipina 1955, p. 39, Plate 3, figs. 9, 12, 13.

Endothyra (?) *minuta*; Malakhova, 1956 (part), p. 105, Plate 5, fig. 1 (only).

Endothrya taedia Zeller, 1957, p. 700-701, p. 79, fig. 11, Plate 80, fig. 12.

(not) *Endothyra* (?) *minuta*; Durkina, 1959, p. 162, Plate 8, fig. 1.

Septabrunsiina minuta (part) Lipina, 1965, p. 52-54, Plate 11, figs. 9-11, 14-25 (only).

Septabrunsiina minuta forma brunsiinoides OBJ, infrasubspecific; Lipina, 1965, p. 54, Plate 11, figs. 18-25.

(not) *Septabrunsiina minuta* forma glomospiroides OBJ, infrasubspecific; Lipina, 1965, Plate 11, figs. 26, 28, 29.

Septabrunsiina minuta forma tournayelloides OBJ, infrasubspecific; Lipina, 1965, p. 54, Plate 11, figs. 9-11, 14-17.

(not) *Septabrunsiina minuta* forma tournayelloides OBJ, infrasubspecific; Brazhnikova et al., 1967, p. 198, Plate 4, fig. 13.

cf. *Septabrunsiina minuta* forma tournayelloides OBJ, infrasubspecific; Dvorak and Conil, 1968, p. 81, Plate 1, fig. 11.

(not) *Septabrunsiina minuta*; Bogush and Yuferev, 1970, p. 98, Plate 2, figs. 23-24.

(not) *Septabrunsiina minuta* forma brunsiinoides OBJ, infrasubspecific; Brazhnikova and Vdovenko, 1971, p. 150, Plate 14, fig. 11.

Septabrunsiina minuta forma tournayelloides OBJ, infrasubspecific; Brazhnikova and Vdovenko, 1971, p. 150, Plate 14, figs. 5, 9-10.

(not) *Septabrunsiina minuta*; Simonova, 1972, p. 68, Plate 3, figs. 3, 5, 6.

(not) *Septabrunsiina minuta* forma tournayelloides OBJ, infrasubspecific; Simonova, 1972, p. 62, Plate 2, figs. 15, 19-21 (marked as 2, 9, 11, 17).

(not) *Septabrunsiina minuta elegantula*; Brazhnikova and Vdovenko, 1973, Plate 5, figs. 6, 7, 11.

Septabrunsiina minuta; Armstrong and Mamet, 1977, p. 66.

Septabrunsiina (Septabrunsiina) minuta; Conil and Lys, 1977, p. 22.

(not) *Septabrunsiina minuta*; Juferev in Simakov, 1979, p. 21, Plate 1, fig. 13.

Diagnosis. Test free, discoidal, laterally compressed, with faint umbilical depression. Form ratio 1: 0.3 to 0.4. Proloculus variable, 25-35 µm, followed by a very tightly coiled spirotheca. Earliest coils variable, erratic to planispiral, followed by a partially evolute planispiral spirotheca. Diameter of adult specimens of four whorls, 350 to 400 µm. Early coils with rough pseudoseptation, then blunt septa in the last volution. Ten to twelve low chambers in the last coil. Septa at very low angle from the spirotheca. No secondary deposits. Wall, an undifferentiated tectum. Aperture, a low slit at open end of tube.

Remarks. Our forms are identical to *Endothyra taedia*, which shows intraspecific variation between completely planispiral forms and taxa with early glomospiral coil(s). Lipina observed the same phenomenom in her Russian material, which lead to the erection of three infrasubspecific "forma": brunsiinoides OBJ, tournayelloides OBJ, and glomospiroides OBJ. If such extreme coiling variation is of intraspecific value, one may question its use as a generic or even familial criterion as proposed by Conil and Lys (1977).

Stratigraphic distribution and range. Original material from Zeller comes from the upper Tournaisian bed 36, Blacksmith Fork section, and from the lower Viséan bed 12, same section. Original Russian material comes from the middle Tournaisian, and Lipina originally considered the species to be characteristic of the Cherepet. It has since been found in younger horizons. In the Monkman Pass area, the taxon is scarce in the upper Tournaisian and exceptionally rare in younger strata. The figured specimen is the highest known occurrence.

Genus *Spinobrunsiina* Conil and Lys, 1977

Spinobrunsiina anteflexa (Zeller, 1957)

Plate 1, fig. 10

Plectogrya anteflexa (part) Zeller, 1957, (not Plate 79, fig. 10), Plate 82, fig. 6?, 11 (holotype), (not 12), Plate 82, figs. 8-12.

?*Endothyra* ? *morroensis* McKay and Green, 1963, p. 35, Plate 2, figs. 2?, 8, 9.

(not) *Chernyshinella anteflexa*; Skipp, in McKee and Gutschick 1969, p. 224-225, Plate 17, figs. 7, 12-14.

Septabrunsiina anteflexa; Mamet, 1976, no description, Plate 79, fig. 6.

Septabrunsiina anteflexa; Armstrong and Mamet, 1977, p. 66.

Diagnosis. Test free, discoidal, laterally compressed. Periphery subrounded. Proloculus 30-40 µm, followed by an irregular spirotheca. Adult forms of three and one half to four volutions have diameter of 400-500 µm. Early coils pseudoseptated. In the last volution, septa are short, very oblique from the spirotheca. Chambers elongate, five to six in the last whorl. Sutures well marked. Secondary deposits as disconnected nodes and corner fillings. Wall undifferentiated, a tectum, 15-20 µm thick.

Remarks. The original material appears to be quite inhomogeneous. The specimen figured on Plate 79, figure 10 is to be transferred to *Septabrunsiina minuta* (see Lipina, 1965, p. 52 for discussion). The holotype has been placed by Lipina in synonymy with *Septabrunsiina krainica*. There is obviously ample similarity between the Russian and the American material. However, Zeller's forms have consistent nodes, which are unknown among true *krainica*. Zeller's holotype is therefore transferred to the newly created *Spinobrunsiina*. Finally, Plate 81, figure 12 of Zeller (1957) belongs to the genus *Chernyshinella*.

Skipp (in McKee and Gutschick, 1969) has proposed the inclusion of Zeller's Plate 82, figures 8, 9 in her new species *Septabrunsiina rossi*. This treatment is not convincing as *rossi* has no secondary deposits and much thinner walls.

Stratigraphic range and distribution. Zeller's material is of middle and late Tournaisian age. The holotype comes from bed 31, South Teton section, which belongs to the highest part of Zone 7 or to basal Zone 8. The material of the Monkman Pass region is from zones 8 and 9, in the Pekisko and Shunda formations.

Spinobrunsiina parakrainica (Skipp, Holcomb and Gutschick, 1966)

Plate 1, figs. 12-17

Septabrunsiina parakrainica Skipp, Holcomb and Gutschick, 1966, p. 21-22, Plate 1, figs. 20-23, 25-28, (not 24), Plate 4, fig. 10.

Septabrunsiina parakrainica; Armstrong, 1967, p. 73, Plate 8, figs. 1-3, 4?

Septabrunsiina parakrainica; Skipp in McKee and Gutschick, 1969, p. 222, Plate 16, figs. 20-23, 25-28 (not 24), Plate 24, fig. 15.

Septabrunsiina parakrainica; Armstrong and Mamet, 1976, no description, Plate 1, fig. 8, Plate 2, fig. 3.

Septabrunsiina parakrainica; Mamet 1976, no description, Plate 13, fig. 3, Plate 14, fig. 7, Plate 78, figs. 1-4, Plate 79, figs. 3, 8.

Eblanaia parakrainica; Conil and Lys, 1977, p. 30-31.

Diagnosis. Test free, discoidal, evolute, strongly umbilicated. Periphery smooth. Form ratio 1: 0.3 to 0.4. Proloculus spherical, 35 to 50 µm, followed by one or two very tight erratic coils, then by four to five evolute, regular, planispiral spires. Adults of four and one half to six volutions vary from 500 to 700 µm. Forms of six to seven volutions reach an average 720 to 740 µm. Rate of expansion rather slow. Pseudoseptation poorly developed in the erratic portion, then becoming progressively more prominent in the planispiral coils. Seven to eight pseudochambers in the penultimate coil and seven to nine chambers in the ultimate volution. Chambers low, long, not inflated. Sutures faint. Septa very oblique, short, 30-45° from the spirotheca. Secondary deposits as low anteriorly directed basal ridges. Some septal thickening and corner filling. Wall moderately thick, questionably differentiated?, 17 to 22 µm in the last chamber. Aperture, a high slit at the base of the apertural face.

Remarks. Skipp, Holcomb and Gutschick (1966) originally reported a wall 35 µm thick, although their illustrations show a considerably thinner spirotheca. The holotype is heavily recrystallized and the wall structure is impossible to assess. The rest of the fauna is tournayellid, as is our material. Conil and Lys (1977) placed *parakrainica* in the genus *Eblanaia*, which is not in the Tournayellidae. We consider the taxon to be a spinose representative of *Septabrunsiina*, and it is therefore transferred to *Spinobrunsiina*.

Stratigraphic range and distribution. Upper Tournaisian and lower Viséan in Arizona and New Mexico. Also known from the Shunda Formation of Alberta and from an unnamed formation of British Columbia (Mamet, 1976). In the Monkman Pass area, the species occurs for the first time at the Zone 8/9 boundary in the Shunda Formation; quite abundant in zones 9 and 10 in the Unnamed unit, in the Shunda Formation, and in the basal Turner Valley Formation.

Spinobrunsiina mackeei (Skipp, Holcomb and Gutschick, 1966)

Plate 2, figs. 1, 2

Endothyra spp. McKay and Green, 1963, no description, Plate 6, figs. 2, 7?.

Septabrunsiina mckeei Skipp, Holcomb and Gutschick, 1966, p. 21, Plate 1, figs. 29-34.

Septabrunsiina mckeei; Skipp in McKee and Gutschick, 1969, p. 222, Plate 16, figs. 29-34 (same as 1966).

Diagnosis. Test free, discoidal, laterally compressed, partly evolute, with poor umbilical depression. Form ratio 1: 0.3. Proloculus small, followed by tight, erratic, then planispiral coils. Diameter, approximately 450 to 500 µm, for adults of five volutions. Height of last chamber, 40 to 60 µm. Earliest portion, pseudoseptate. Last two volutions have oblique septa. Chambers low, elongate, eight to nine in the last coil. Secondary deposits as faint resorbed spines in the last whorl. Wall, an undifferentiated tectum, thin to medium thick, about 15 µm in the last chamber. Aperture, a basal slit.

Remarks. The species is characterized by a very slow expansion of the spirotheca. The original description reports no secondary deposits. They are visible, however in Figure 32, Plate 1. They are also present in the samples of McKay and Green. Our material shows some resemblance to cf. "*Septabrunsiina*" Dil (1977, Plate 5, fig. 79), which also should be transferred to *Spinobrunsiina*.

Stratigraphic range and distribution. Scarce and quite poorly known. The samples of McKay and Green come from the lower Viséan part of the Livingstone Formation of Alberta. Skipp's material from the Redwall Limestone of Arizona is the same age. The material of the Monkman Pass area is from the lower Viséan part of the Mount Head(?) Formation and from the uppermost Tournaisian part of the Shunda Formation.

Genus *Spinotournayella* Mamet in Mamet, Mikhailov and Mortelmans, 1970

Spinotournayella tumula (Zeller, 1957 *emend*. Mamet in Mamet, Mikhailov and Mortelmans, 1970)

Plate 2, figs. 3, 4

Plectogyra tumula (part) Zeller, 1957, Plate 77, fig. 5, Plate 79, figs. 7-9, Plate 82, fig. 3 (other figures of Zeller are assigned to *Tuberendothyra tuberculata* or *Spinoendothyra*).

Plectogyra sp. Zeller, 1957, Plate 82, fig. 1.

(not) *Plectogyra tumula*; Woodland, 1958, p. 798, Plate 101, figs. 12, 14, 15.

Endothyra tumula; Rozovskaia, 1963, p. 27.

?*Endothyra tumula* (part); MacKay and Green, 1963, p. 40, Plate 3, fig. 15? (not Plate 1, figs. 1, 4, 5, not Plate 2, fig. 17, not Plate 3, fig. 13, not Plate 4, figs. 7, 9, 11).

?*Carbonella tumula*; Bogush and Yuferev, 1966, p. 112, Plate 5, fig. 19.

Spinotournayella tumula; Mamet in Mamet, Mikhailov and Mortelmans, 1970, p. 44.

Septatournayella tumula; Brenckle, 1973, p. 30 (part), Plate 3, figs. 8, 9?

Spinotournayella tumula; Conil and Lys, 1977, p. 31, Plate 5, fig. 78 (reproduction of Zeller's holotype, Plate 79, fig. 9).

Spinotournayella tumula; Armstrong and Mamet, 1977, p. 66.

Septatournayella (*Pohlia*) sp. Conil and Lys, 1977, p. 18, Plate 1, fig. 12 (reproduction of Zeller's Plate 82, fig. 1).

Diagnosis. Test free, discoidal, nearly completely planispiral, flattened, with depressed umbilici. Proloculus spherical, prominent, 50 to 60 µm, followed by one slightly irregular coil, then by a regular planispiral spirotheca. Rate of expansion progressive. Diameter of adult specimens (4-5 whorls) ranges from 550 to 800 µm. Last whorl has seven to eight chambers. Total number of chambers and pseudochambers 30 to 34. Pseudoseptation in the early coils. True subglobose chambers in last coils. Earliest pseudosepta very oblique, cuneiform. Later septa, oblique, at 40-45° from the spirotheca, never long. Secondary deposits, well developed broad tumuli, occurring from the first coil onwards. Wall calcareous secreted, one-layered (tectum), 20 to 25 µm in the last chamber. Aperture prominent, a high slit, up to a third of the apertural face.

Remarks. *Spinotournayella* is one of the most advanced Tournayellidae, with an important development of secondary deposits.

Stratigraphic range and distribution. Spinotournayella has been erroneously reported from Europe by Conil and Lees (1975). *Sp. tumula* is perhaps present in Siberia, but its usual occurrence is in the North America Cordillera. It is known from New Mexico to British Columbia and is characteristic of the upper Tournaisian (see Mamet in Mamet et al., 1970). In the Monkman Pass area, *Sp. tumula* is present in the Pekisko Formation (Zone 8) and is less abundant in the overlying Shunda Formation (Zone 9).

Family FORSCHIIDAE Dain, 1953 *non sensu* Conil and Lys, 1977

Genus *Pohlia* Conil and Lys *emend.*

Pohlia henbesti (Skipp, Holcomb and Gutschick, 1966), Plate 2, figs. 5-10, Plate 3, fig. 1.

Septatournayella henbesti Skipp, Holcomb and Gutschick, 1966, p. 25, Plate 2, fig. 10?, 16-19, Plate 3, figs. 1, 3-7, Plate 4, figs. 11, 12.

Septatournayella henbesti; Skipp in McKee and Gutschick, 1969, p. 225, Plate 24, fig. 17, Plate 25, figs. 10, 16-19 (same figures as above).

"*Septatournayella*" *henbesti*; Armstrong and Mamet, 1972, p. 135, fig. 5B.

"*Septatournayella*" *henbesti*; Mamet, 1976, Plate 42, fig. 3, Plate 63, fig. 4, Plate 84, fig. 2.

Septatournayella (*Pohlia*) *henbesti*; Conil and Lys, 1977, p. 18 (reproduction of Skipp, Holcomb and Gutschick, 1966), Plate 1, figs. 10-11.

Diagnosis. Test free, discoidal, evolute throughout. Form ratio 1: 0.30. Diameter 780 to 1400 µm, with an average near 900 to 1000 µm, for adult specimens of five to seven coils. Proloculus spherical, 50 to 60 µm, followed by a moderately expanding spire. Sometimes, a slight deviation is observed in the first coil. Pseudoseptation very variable, occurring as early as the first volution, sometimes in later coils. True septa in the last volution. Septa short, very oblique. Secondary deposits as low mounds, connected by low floor coverings. As for the pseudoseptation, secondary deposits sometimes occur in the early stage, and sometimes much later. Seven to eight pseudochambers in the penultimate coil and same number of chambers in the ultimate volution. Wall calcareous, a differentiated tectum with some agglutinated material. Rapid increase in thickness, from very thin at the proloculus to thick in the outer whorl (22-32 µm, sometimes 35 µm). Aperture prominent, at the base of the apertural face.

Remarks. The original description mentions a fine- to coarse-granular wall. Examination of the published type-material shows a clearly defined differentiation (see the type, or Plate 3, fig. 4) and some agglutination. The same characteristics are visible in "*Septournayella*" *henbesti*; Mamet, 1976. This forschiid wall coupled with the presence of secondary deposits precludes assignment of the species to *Septatournayella*. Unfortunately, in 1977, Conil and Lys used *henbesti* as the type of a new subgenus *Septatournayella* (*Pohlia*), which they considered to be a tournayellid. *Pohlia* is here transferred to the Forschiidae and is formally emended to include forms with agglutination.

Stratigraphic range and distribution. Originally reported from the lower and middle Viséan of Arizona. Similar distribution in the Mount Head Formation of Alberta, the Debolt Formation of British Columbia, the Flett Formation of the District of Mackenzie and the Kayak(?) Shale of Alaska. In the Monkman Pass area, it first occurs at the Shunda - Turner Valley contact (Zone 9/10 boundary). Fairly abundant in zones 10, 11, 12, in the Turner Valley and Mount Head(?) formations.

Genus *Eoforschia* Mamet in Mamet, Mikhailov and Mortelmans, 1970

Eoforschia of the group *E. moelleri* (Malakhova in Dain, 1953).

Plate 3, figs. 2, 3

For synonymy, see Armstrong and Mamet, 1977 and add:

Eoforschia cf. *E. nonconstricta*; Brenckle, 1973, p. 26-27, Plate 2, figs. 2-8.

Tournayella (*T.*) *moelleri*; Brazhnikova and Vdovenko, 1973, no description, Plate 4, figs. 3-4.

Tournayella moelleri; Malakhova, 1973, p. 14, Plate 1, fig. 1, Plate 2, figs. 5, 6.

Tournayella cf. *moelleri*; Malakhova, 1973, p. 14, Plate 1, figs. 4, 5, Plate 2, fig. 2.

Tournayella moelleri; Grozdilova et al., in Stepanov et al., 1975, p. 28-29, Plate 1, figs. 9, 10.

Eoforschia moelleri; Mamet 1976, no description, Plate 32, figs. 3-4, Plate 66, fig. 4, Plate 67, figs. 3, 4, Plate 68, figs. 2-4, Plate 69, fig. 4.

Eoforschia moelleri; Conil and Lys, 1977, p. 18-19, Plate 1, figs. 15, 16 (reproduction of Malakhova in Dain, 1953).

Tournayella moelleri; Grozdilova and Lebedeva in Sultanaev et al., 1978, no description, Plate 1, fig. 4.

Eoforschia of the group *E. moelleri*; Bamber and Mamet, 1978, no description, Plate 2, fig. 2, Plate 3, fig. 3.

Diagnosis. Test free, lenticular. Proloculus approximately 50 to 70 µm, followed by an evolute, planispirally coiled spirotheca. Rate of expansion moderate. Form ratio about 1: 0.25-0.3. Some constrictions, generally in the last whorl, sometimes in the penultimate whorl. Diameter 700 to 1200 µm (average 1050 µm) for adult forms of six to seven whorls. Six to seven pseudochambers in the last whorl. Thickness of wall increases rapidly from very thin in the earliest coil, to thick (30-35 µm) in the last whorl. Wall differentiated, two layered, with some agglutinated particles. Aperture simple, crescentic, at open end of tube.

Stratigraphic range and distribution. Uppermost Tournaisian and Viséan of the Northern Hemisphere (for details, see Armstrong and Mamet, 1977). In the Monkman Pass area, the taxon first occurs in Zone 9 and becomes abundant in zones 10, 11 and 12. Ubiquitous in the uppermost part of the Shunda Formation, the Turner Valley and Mount Head(?) formations, and the Unnamed unit.

Genus *Conilites* Vdovenko, 1970

Conilites tchussovensis Postojalko in Stepanov et al., 1975

Plate 3, figs. 7-11

Conilites tchussovensis Postojalko in Stepanov et al., 1975, p. 29, Plate 1, fig. 15.

Diagnosis. Test free, discoidal, laterally compressed. Form ratio 1: 0.65 or less? Proloculus prominent, reaching 80 to 100 µm, followed by a planispirally coiled rapidly expanding spirotheca. Earliest coil has faint deviation, later coils are regular. Diameter of the planispiral part 700 to 1000 µm. Later stage uncoiled, often crushed. Early pseudochambers in first coil, followed by true septation in the last two coils. Six to eight chambers in last volution, usually seven. Septa, curved, anteriorly directed, delimiting subglobular chambers. Wall thickness increases quite rapidly, reaching 50 to 60 µm in the uncoiled portion. Secondary deposits as strongly resorbed spinose projection and interconnecting low floor deposits. Wall clearly differentiated in two layers with some agglutinated material. Nature of the aperture unknown in our material.

Remarks. *"Carbonella" spectabilis crassa* Lipina (1955) (not a *Carbonella*), *Septatournayella* (?) *conspecta* Conil and Lys (1967) (now *Viseina*), *Ammobaculites* (?) *dinantii* Conil and Lys (1964) (now *Conilites*), and *Conilites tchussovensis* Postojalko (1975) are probably related. They have exactly the same stratigraphic distribution and the same characteristic heavy forschiid pseudoseptation. They differ only in minor characteristics, such as proloculus size, degree of development of secondary deposits, development of advanced uncoiled stage, etc. Our material apparently has a greater regularity of the planispiral coil than does the original material from the Urals. It must be noted, however, that Postojalko's species is illustrated by only a single section. It differs from *Conilites dinantii* by having more highly developed secondary deposits. Although these are not reported by Conil and Lys (1964), they are visible in their holotype on Plate 9, figure 154. If our concept is correct, *Viseina* is an immature form of *Conilites*.

Stratigraphic range and distribution. Scarce. In the Urals (Chussova River), known from the lower Viséan Kosvinsk Horizon (C_1v_1, Zone 10). In British Columbia, known from only one locality (GSC loc. C-39452), Turner Valley Formation, of early Viséan age (Zone 10), East Feller's Creek section.

Family ENDOTHYRIDAE Brady, 1884 *sensu lato*

Genus *Latiendothyra* Lipina, 1963

Latiendothyra of the group *L. parakosvensis* (Lipina, 1955)

Plate 3, fig. 4

For the synonymy of the species and of the group, see Armstrong and Mamet (1977) and add the following for the species only:

(not) *Endothyra parakosvensis* Solovjeva, 1972, p. 20, Plate 1, figs. 13-14.

Endothyra (*Latiendothyra*) *parakosvensis* Grozdilova et al. in Stepanov et al., 1975, p. 36, Plate 4, figs. 9, 10.

Latiendothyra parakosvensis Mamet, 1976, no description, Plate 13, fig. 1, Plate 14, fig. 1, Plate 53, fig. 2.

Latiendothyra parakosvensis Armstrong and Mamet, 1977, p. 51-52.

Endothyra parakosvensis nigra Dil, 1977, no description, Plate 1, fig. 14.

Endothyra (*Laxoendothyra*) *parakosvensis* Lipina, 1977, p. 13, Plate 1, figs. 2, 3.

Endothyra parakosvensis beruinae Conil in Kimpe et al., 1978, p. 61, Plate 8, figs. 24, 30, Plate 9, figs. 31-36.

Endothyra parakosvensis nigra Conil in Kimpe et al., 1978, Plate 8, fig. 25.

Endothyra parakosvensis Juferev in Simakov, 1979, p. 23, Plate 2, fig. 1.

Enodothyra parakosvensis forma minima OBJ, infrasubspecific, Juferev in Simakov, 1979, p. 23, Plate 2, fig. 2.

Diagnosis (of the species). Test free, subglobular to globular, with depressed umbilici. Periphery rounded. Proloculus, 35 to 60 µm, followed by an erratically coiled spirotheca. Form ratio 1: 0.5 to 0.6. Sutures marked. Chambers subrounded to globular. Septa at low angle from the spirotheca, some blunt, resorbed, some long, curved. Adult specimens of three and one half to four whorls vary from 450 to 800 µm (average approximately 650 µm). Spire expands rapidly in the last volution. Seven to eight chambers in the last coil, sometimes nine. Basal deposits absent, or as inconspicuous residual hook. Wall calcareous secreted 15 to 20 µm, sometimes 25 µm. Aperture, a rather high basal slit.

Remarks. The species has been attributed to *Latiendothyra* and to *Laxoendothyra*. These two genera are morphologically identical and have the same stratigraphic distribution. Traditionally they are distinguished by the presence or absence of secondary deposits. These are always residual. The type *Latiendothyra* (*L. latispiralis* Lipina) sometimes exhibits residual nodes (whereas *Latiendothyra* is reported to be without secondary deposits), and the type *Laxoendothyra* (*L. laxa* is normally devoid of any secondary deposits (whereas *Laxoendothyra* is reported to be spinose). Therefore the distinction between the two genera appears artificial and will not be followed here. Our illustrated specimen shows a residual spine in the ultimate coil.

Stratigraphic range and distribution. A common cosmopolitan species of latest Famennian and Tournaisian time. In the Canadian Cordillera, illustrated by Mamet (1976) from Zone "pre-7" to Zone 9. In the Monkman Pass area, the species is widespread in zones 7, 8 and 9, in the Pekisko and Shunda formations.

Latiendothyra rjausakensis (Chernysheva, 1940)

Plate 3, fig. 5

Endothyra rjausakensis Chernysheva, 1940, p. 127, Plate 1, fig. 3, Plate 2, fig. 10.

Endothyra rjausakensis; Lipina, 1955, p. 65.

(not) *Endothyra rjausakensis* var. magna Lipina, 1955, OBJ, preoccupied; p. 67-68, Plate 9, figs. 7-10.

Plectogyra rjausakensis; Bogush and Yuferev, 1962, p. 138-139, Plate 4, fig. 6.

Endothyra rjausakensis; Rozovskaia, 1963, p. 27.

Latiendothyra rjausakensis; Anonymous, 1963, p. 225.

Plectogyra antiqua Conil and Lys, 1964, p. 164, Plate 23, figs. 460-462.

Endothyra rjausakensis; Bogush and Yuferev, 1966, p. 125-126, Plate 7, figs. 4-7.

Plectogyra antiqua; Conil and Lys, 1967, Plate 3, figs. 26-29.

Plectogyra rjausakensis; Brazhnikova et al., 1967, p. 198, Plate 1, figs. 11, 12.

Endothyra rjausakensis; Conil and Lys, 1968, p. 521-522.

?*Endothyra rjausakensis*; Bogush and Yuferev, 1970, p. 101, Plate 5, fig. 8.

(not) *Endothyra rjausakensis* var. magna OBJ, Bogush and Yuferev, 1970, p. 101, Plate 5, figs. 9, 10.

Plectogyra ex. gr. *rjausakensis*; Brazhnikova and Vdovenko, 1971, p. 198, Plate 32, figs. 4, 5, 8, 9.

Endothyra rjausakensis; Segura, 1973, no text, p. 241, Plate 3, fig. 31.

?*Endothyra* aff. *rjausakensis*; Segura, 1973, p. 250, no text, Plate 3, fig. 35.

Latiendothyra of the group *L. rjausakensis*; Verville et al., 1973, Plate 3, fig. 7.

Plectogyra ex. gr. *rjausakensis*; Malakhova, 1973, p. 166, Plate 3, fig. 5.

Latiendothyra rjausakensis; Mamet, 1976, no description, Plate 54, fig. 4.

Latiendothyra rjausakensis; Armstrong and Mamet, 1977, p. 51-52.

(not) *Endothyra* (*Granuliferella*) *rjausakensis*; Lipina 1977, p. 13, Plate 1, fig. 5.

(not) *Endothyra* (*Granuliferella*) *rjausakensis* var. magna OBJ, preoccupied; Lipina, 1977, p. 13.

(not) *Endothyra* (*Latiendothyra*) *rjausakensis*; Vachard, 1977, p. 141, Plate 3, fig. 2.

Diagnosis. Test free, subglobular, laterally compressed, with some umbilical depressions. Proloculus 35 to 50 µm, followed by a loosely coiled, irregular spirotheca. Adult specimens of three whorls, 400 to 600 µm, in diameter exceptionally up to 620 µm. Form ratio 1: 0.75 to 0.90. Usually six to seven chambers in the last whorl. Chambers subglobose, rather regular. Septa curved, long, oblique (45-50°) from the spirotheca, with characteristic thickening and plough-shaped tip. Septal sutures marked. Wall undifferentiated, thick, 20 to 25 µm in the last whorl.

Remarks. The characteristic shape of the septa makes this species similar to "*Plectogyra*" *menneri* of Bogush and Yuferev (1960), which is somewhat larger, has more chambers per whorl, and has more compressed flanks. The taxonomic treatment of *menneri* and *rjausakensis* proposed by Conil (in Conil et al., 1977, p. 219-221) confuses latiendothyrids with endothyranopsids.

Stratigraphic range and distribution. Originally reported from the middle Tournaisian of the southern Urals. Later described by Russian paleontologists from upper Tournaisian and lower Viséan. Reports of younger occurrences should be discarded. A rather common latiendothyrid in the upper Tournaisian, and less abundant in the lower Tournaisian of the Monkman Pass area [Shunda and Mount Head(?) formations]. Also illustrated from the middle Tournaisian Banff Formation of British Columbia (Mamet, 1976).

Genus *Priscella* Mamet, 1974

Priscella of the group *P. prisca* (Rauzer-Chernoussova and Reitlinger, 1936)

Plate 3, fig. 6

For synonymy of the group, see Armstrong and Mamet, 1977, and add:

Endothyra prisca; Solovjeva, 1972, p. 22, Plate 1, fig. 21.

(not) *Plectogyra prisca*; Malakhova, 1972, p. 39, Plate 4, fig. 1.

"*Endothyra*" of the group "*E.*" *prisca*; Mamet, 1973, Plate 6, fig. 11, Plate 8, fig. 7.

"*Endothyra*" of the group "*E.*" *prisca*; Alexandrowicz and Mamet, 1973, Plate 2, fig. 2, Plate 4, fig. 6.

Endothyra (*Endothyra*) *prisca prisca*; Brazhnikova and Vdovenko, 1973, p. 182-183, Plate 16, figs. 8, 9?, 12, 21.

Endothyra (*Endothyra*) *prisca prisca* forma crassitheca OBJ, infrasubspecific, Brazhnikova and Vdovenko, 1973, Plate 16, figs. 18, 24, 25.

Endothyra (*Endothyra*) *prisca prisca* forma plana OBJ, infrasubspecific, Brazhnikova and Vdovenko, 1973, Plate 16, figs. 19, 23.

Endothyra (*Endothyra*) *prisca prisca* forma minima OBJ; infrasubspecific, Brazhnikova and Vdovenko, 1973, Plate 16, figs. 14-16.

Endothyra (*Endothyra*) *prisca* var. devia OBJ, infrasubspecific, Brazhnikova and Vdovenko, 1973, p. 182-183, Plate 16, figs. 20, 30.

Priscella prisca; Mamet, 1974, p. 200-201.

Endostaffella fucoides Vachard in Termier et al., 1975, p. 40, Plate 4, figs. 4, 7.

Plectogyra prisca; Malakhova, 1975, p. 25, Plate 14, figs. 15-17.

Endothyra prisca devia OBJ, infrasubspecific, Michno in Michno and Balakin, 1975, p. 38, Plate 6, figs. 5, 6.

Plectogyra prisca; Postojalko, 1975, no text, Plate 4, fig. 14, Plate 18, fig. 23.

Plectogyra prisca; Simonova, 1975, p. 180-181, Plate 3, figs. 1-3 (marked 4).

Endothyra prisca; Solovieva, 1975, p. 51, no text, Plate 9, figs. 6, 7.

Endothyra of the group *E. prisca*; Smirnov et al., 1975, no text, Plate 2, fig. 6.

Priscella of the group *P. prisca*; Mamet 1976, no text, Plate 81, fig. 10, Plate 86, fig. 4.

Priscella prisca; Mamet, 1976, Plate 81, figs. 5-9.

Endothyra prisca; Bogush and Yuferev, 1976, p. 107, Plate 1, figs. 10, 11.

Endothyra cf. *E. prisca*; Monostori, 1976, p. 206, Plate 2, fig. 4.

Endothyra (*Endothyra*) of the group *prisca*; Vachard, 1977, p. 142.

Priscella prisca; Armstrong and Mamet, 1977, p. 56, Plate 29, figs. 1-4, 7.

Endothyra ex. gr. *prisca*; Conil, 1977, no description, p. 391, Plate 5, fig. 49.

Endothyra prisca; Dil, 1977, no description, Plate 7, fig. 111.

Endothyra (*Endothyra*?) *prisca* devia Lipina, 1977, no description, Plate 2, fig. 10.

(not) *Endothyra* ex. gr. *prisca*; Zurkiewicz and Zakowa, 1978, p. 46-47, Plate 18, figs. 5, 6.

Endothyra prisca parva Zurkiewicz and Zakowa, 1978, p. 46, Plate 18, fig. 2.

Endothyra prisca pressa Zurkiewicz and Zakowa, 1978, p. 46, Plate 18, figs. 3, 4.

Endothyra prisca undata Zurkiewicz and Zakowa, 1978, p. 46, Plate 18, figs. 9, 10, 11.

(not) *Endothyra* sp. aff. *prisca* undata; Zurkiewicz and Zakowa, 1978, p. 46, Plate 18, fig. 8.

(not) *Endothyra prisca* "D. Zeller"; Reitlinger 1979, Plate 10, fig. 7.

Priscella prisca; Rich 1980, p. 29-30, Plate 18, fig. 8.

Diagnosis. Test free, small, lenticular, laterally compressed. Proloculus followed by an asymmetrically coiled spirotheca. Extreme variability in the coiling pattern; some forms nearly planispiral oscillating, some completely askew. Adult specimens have two and one half to three and one half volutions with a diameter of 200 to 360 µm. Chambers irregularly subquadratic, seven to nine in the last coil (sometimes 6 or 11). Sutures faint. Septa long. Wall calcareous secreted, a micrógranular tectum, with a probable tectorium(?), about 10 to 12 µm (up to 15 µm) in the last coil. No secondary deposits. Aperture slitlike, at base of apertural face.

Stratigraphic range and distribution. Cosmopolitan in the Northern Hemisphere. Abundant from the upper Tournaisian Zone 9 to the Namurian. In the Monkman Pass area, fairly abundant and widespread in the upper part of the Shunda Formation, the Turner Valley and Mount Head(?) formations, and the Unnamed unit.

Genus *Spinoendothyra* Lipina, 1963 *emend.* Mamet, 1976

Spinoendothyra spinosa spinosa (Chernysheva 1940)

Plate 4, figs. 1-8

Endothyra spinosa Chernysheva, 1940, p. 126, Plate 2, fig. 12.

Endothyra spinosa; Lipina, 1955, p. 62, Plate 8, figs. 3-5.

(not) *Endothyra spinosa*; Malakhova, 1956, p. 115, Plate 13, figs. 8, 9.

?*Plectogyra spinosa*; Lipina, 1959, p. 33.

Plectogyra spinosa; Bogush and Yuferev, 1962, p. 128-129, Plate 3, fig. 3.

Plectogyra (*Spinoendothyra*) *spinosa*; Anonymous, 1963, p. 225.

Endothyra spinosa; McKay and Green, 1963, p. 38, Plate 2, figs. 3, 4.

Endothrya sp. cf. *E. spinosa*; McKay and Green, 1963, p. 39, Plate 4, figs. 1, 12, 14.

Endothyra spp. McKay and Green, 1963, no text, Plate 2, figs. 7, 13, 18.

Plectogyra spinosa; Conil and Lys, 1964, p. 219-220, Plate 37, fig. 749.

(not) *Endothyra* aff. *E. spinosa*; Armstrong, 1967, p. 73, Plate 8, figs. 5, 22.

Endothyra spinosa; Skipp in McKee and Gutschick, 1969, (part), p. 205-206, Plate 19, fig. 5, Plate 20, figs. 1-11 (only).

Endothyra (?) *paraspinosa* Skipp in McKee and Gutschick, 1969, p. 204, Plate 20, figs. 16-17.

Tuberendothyra tuberculata Skipp in McKee and Gutschick, 1969, (part), p. 213-214, Plate 19, figs. 14, 15, 17, Plate 20, figs. 21, 25.

Plectogyra spinosa forma typica OBJ, infrasubspecific, Brazhnikova and Vdovenko, 1971, p. 204, Plate 41, figs. 9, 14, 15, 18.

(not) *Plectogrya* ex. gr. *spinosa*; Brazhnikova and Vdovenko, 1971, p. 204, Plate 41, fig. 13.

(not) *Endothyra spinosa*; Solovieva, 1972, p. 19, 20, Plate 11, fig. 12.

(not) *Endothyra* (*Spinoendothyra*) ex. gr. *spinosa*; Brazhnikova and Vdovenko, 1973, Plate 17, fig. 32.

Spinoendothyra spinosa; Mamet, 1976, Plate 11, fig. 3, Plate 13, fig. 2, Plate 56, fig. 4, Plate 57, figs. 3, 4, Plate 58, figs. 1-4.

Spinoendothyra spinosa; Armstrong and Mamet, 1976, p. 13, Plate 1, fig. 4, Plate 2, figs. 1-3.

Spinochernella brencklei Conil and Lys, 1977, p. 29-30, fig. 71 (not fig. 78).

Spinoendothyra spinosa; Armstrong and Mamet, 1977, p. 66.

Endothyra (Spinoendothyra) spinosa; Dil, 1977, no description, Plate 3, fig. 41.

Spinoendothyra spinosa; Bamber and Mamet, 1978, no description, Plate 1, fig. 4.

cf. *Septabrunsiina (Spinobrunsiina)* Conil et al., 1980, no description, Plate 2, fig. 8.

Septabrunsiina (*Spinobrunsiina* sp. Conil et al., 1980, no description, Plate 3, fig. 6.

Tuberendothyra sp. Conil et al., 1980, no description, Plate 3, fig. 8.

Endothyra (?) aff. *paraspinosa* Conil et al., 1980, no description, Plate 3, fig. 10.

Diagnosis. Test free, irregularly discoidal, slightly compressed laterally. Form ratio 1: 0.5 to 0.6. Proloculus spherical, 40 to 50 µm, followed by an irregularily coiled spirotheca. Early coils with strong deviation. Later whorls more regular, oscillating. Rate of expansion, slow in the glomospiral part, then more rapid in the last whorl. Diameter for adult specimens of seven to eight chambers, 400 to 600 µm, exceptionally up to 650 µm. Average diameter 500 to 550 µm for three and one half to four whorls. Umbilical depression slight. Chambers subglobular with depressed, marked sutures. Septa irregular, long, anteriorly curved, oblique, at 70° from the spirotheca. Secondary deposits as strong, long, anteriorly curved spines starting immediately after the proloculus and present in the whole test. No basal connections between the spines. Resorption variable. No septal thickening. Wall calcareous secreted, 14 to 20 µm in the last chamber. Differentiation in tectoria poorly defined, but conspicuous. Aperture a low slit at the base of the apertural face.

Remarks. Our forms are very similar to the original material of Chernysheva (which is of the same age), but the variation in diameter is wider. The original description states that the wall is granular with a fibrous layer. This results from a misinterpretation of a recrystallized differentiated tectum/tectorium.

The new genus *Spinochernella* Conil and Lys (1977) is a *Spinoendothyra* with resorbed early septa. This phenomenon is erratic and cannot be relied upon for erection of distinct genera. Although Conil and Lys did not state which formation yielded the new taxon (except for an ambiguous assignment to a Tournaisian provenance), the unique type specimen shows a thick oolitic coating and is probably derived from Zone 9 in the Leadville Limestone (Armstrong and Mamet, 1976).

Stratigraphic range and distribution. A very abundant and easily recognizable world-wide taxon in the upper Tournaisian. Present but less abundant in the lower Viséan, where it becomes extinct. In North America, the taxon has been illustrated by Skipp from the upper Tournaisian of Arizona, by McKay and Green from the Shunda and "Turner Valley" formations of Alberta, and by Mamet (1976) from the lower part of the Debolt Formation and the Shunda Formation in Alberta and British Columbia. In Monkman Pass area, the species is abundant in the Shunda Formation and its lateral equivalents in the Unnamed unit, from the Zone 8/9 boundary to the Zone 9/10 boundary. The taxon is scarce in the lower Viséan Turner Valley Formation.

Spinoendothyra spinosa crassitheca subsp. nov.

Plate 4, figs. 9-12, Plate 5, figs. 1-4

Holotype - GSC 65774, Plate 5, fig. 1

Endothyra spinosa forma magna OBJ, preoccupied, Lipina, 1955, p. 63, Plate 8, figs. 6, 7(?)

Plectogyra spinosa forma magna OBJ, infrasubspecific, (part), Brazhnikova et al., 1967, p. 199, Plate 7, fig. 4, (not fig. 1).

Tuberendothyra tuberculata; Skipp in McKee and Gutschick, 1966, (part); Plate 19, figs. 20, 21, Plate 20, figs. 25, 27.

Plectogyra spinosa forma magna OBJ, infrasubspecific and preoccupied, Brazhnikova and Vdovenko, 1971, p. 204, Plate 41, figs. 16-17.

Diagnosis. Test free, irregularly discoidal, slightly compressed laterally. Form ratio 1: 0.55-0.60. Proloculus spherical, up to 60 µm, followed by an irregularly coiled spirotheca. Diameter of adult specimens of seven to eight chambers in the last whorl, 600 to 800 µm, exceptionally up to 860 µm. Average diameter, 700 µm for three and one half to four whorls. Chambers subglobular with marked sutures. Septa irregular, long, curved, anteriorly directed, oblique, at 70° from the spirotheca. Secondary deposits as strong anteriorly curved spines observed through the whole test. Wall calcareous secreted, 23 to 30 µm in the last chamber. Obvious differentiation in tectum and tectoria. Aperture, a low slit at the base of the apertural face.

Remarks. As Lipina herself noted, when she erected the taxon magna OBJ, her material differs from the type *spinosa* by having a slightly greater diameter for the same number of whorls, and by having thicker walls. Unfortunately magna OBJ is preoccupied and hence invalid. Moreover Lipina's illustrations are not very convincing. The sections are too high, do not pass through the proloculus and part of it could belong to *Tuberendothyra*? As our material is much better preserved and leaves no doubt as to its relations with *spinosa*, we propose herein a new subspecies.

Type of the new subspecies. Plate 5, fig. 1.

Stratigraphic range and distribution. Reported from the upper Tournaisian of the Urals and the Donbass. Present in the upper Tournaisian of Arizona. Apparent range in the Monkman Pass area; upper Tournaisian Zone 8 to basal Zone 10 (lower Viséan). Present in the Shunda and the Turner Valley formations.

Spinoendothyra paracostifera (Lipina in Grozdilova and Lebedeva, 1954)

Plate 5, figs. 5-8

Endothyra paracostifera Lipina in Grozdilova and Lebedeva, 1954, p. 87, Plate 10, fig. 13.

Endothyra paracostifera; Lipina, 1955, p. 61, Plate 7, figs. 12-14.

Plectogyra (Spinoendothyra) paracostifera; Anonymous, 1963, p. 225.

(not) *Plectogyra paracostifera* var. plagia OBJ, infrasubspecific, Conil and Lys, 1964, p. 199-200, Plate 33, fig. 648.

Plectogyra (Spinoendothyra) paracostifera; Ganelina, 1966, p. 122, Plate 11, fig. 12.

Tuberendothyra tuberculata; Skipp in McKee and Gutschick, 1969, (part), p. 213-214, Plate 19, figs. 18, 19.

(not) *Plectogyra paracostifera*; Brazhnikova and Vdovenko, 1971, p. 204, Plate 41, fig. 8.

Endothyra (Spinoendothyra) paracostifera; Brazhnikova and Vdovenko, 1971, Plate 18, figs. 1, 2, 4.

?*Endothyra paracostifera*; Michno in Michno and Balakin, 1975, p. 37, Plate 5, figs. 16, 17.

Plectogyra paracostifera; Malakhova, 1975, p. 26, Plate 15, fig. 5.

Spinoendothyra paracostifera; Armstrong and Mamet 1976, p. 13.

Spinoendothyra paracostifera; Mamet 1976, Plate 8, fig. 4.

Spinendothyra paracostifera; Armstrong and Mamet, 1977, p. 66.

Endothyra (Spinoendothyra) paracostifera; Conil in Groessens et al., 1977, p. 31, Plate 1, fig. 17.

cf. *Spinoendothyra* sp. Conil et al., 1980, no description, Plate 3, fig. 13.

Diagnosis. Test free, irregularly coiled, slightly depressed laterally. Form ratio approximately 1: 0.5-0.6. Continuous deviation of the coiling by oscillation. Rate of expansion rather slow and constant. Some tendency to evolution in the last whorl. Diameter of adult specimens of nine to ten chambers, 500 to 600 µm, with an average of 540 µm. Width 300 to 340 µm for specimens of three and a half to four whorls. Initial chamber 40 to 50 µm. Sutures oblique at 60° to 80° from the spirotheca, highly variable. Secondary deposits as discrete, long, anteriorly curved spines, present throughout the test. Resorption variable. No septal thickening. Wall differentiated in tectum and tectoria, about 15 µm in the last chamber. Aperture, a low slit at the base of the apertural face.

Remarks. There is considerable difficulty in determining the valid author of the taxon. Ellis and Messina (1964) credit the species to Grozdilova and Lebedeva, whereas these authors state clearly that they were publishing the diagnosis of Lipina "with the author's consent". However, they did not designate a holotype, but chose a plesiotype from the VNIGRI collection. In the following year, Lipina produced a closely similar diagnosis (the wording and figures are not identical), with a designated holotype from the Kizel horizon (Academy of Sciences 3415/20i). Because Grozdilova, Lebedeva and Lipina studied practically identical material, there is no threat to the stability of the taxon and no need for an opinion from the International Commission of Zoological Nomenclature. Our material is practically identical to the published figures of Lipina (1955). The species shows a slower expansion of the spirotheca than in *Spinoendothyra spinosa*.

Stratigraphic range and distribution. Russian authors unanimously report the species from the upper Tournaisian (zones 8 and 9). Groessens et al. (1977) illustrate the taxon from bed 225 of the Landelies section which they designated "Lower Viséan VIa". Their Tournaisian-Viséan boundary in that section is eight metres lower than determined by Mamet et al. (1970), and bed 225 should still be considered late Tournaisian. The report of the species by Conil and Lys (1964) in the middle Viséan is based on a misidentification. In the Monkman Pass area, the species is very abundant in the upper Tournaisian (Zone 9) and disappears at the base of the Viséan.

Spinoendothyra paratumula (Skipp in McKee and Gutschick, 1969)

Plate 5, figs. 9-14

Plectogrya tumula (part) Zeller, 1957, p. 697, Plate 77, fig. 6 (not the holotype which belongs to *Spinotournayella*).

?*Tuberendothyra paratumula* Skipp in McKee and Gutschick, 1967, p. 211-212, Plate 18, figs. 1, 3, 11, 14-18, 24.

Spinoendothyra paratumula; Armstrong and Mamet, 1976, p. 13.

Diagnosis. Test free, discoidal, compressed laterally. Form ratio 1: 0.5. Proloculus spherical, small, 20 to 30 µm, followed by a tightly coiled irregular spirotheca. Rate of expansion progressive. Last whorl more regular, oscillating. Diameter for adult specimens of seven chambers, 380 to 480 µm, with an average of 420 µm. Number of coils three to three and one half. Chambers subglobular, low, with poorly expressed sutures. Septa curved, anteriorly directed, at 40° to 50° from the spirotheca. Secondary deposits as anteriorly directed, disconnected, short spines, commonly resorbed. No septal thickenings. Wall calcareous secreted, thin, 10 to 12 µm in the last whorl, sometimes a little more. Differentiation in tectum/tectoria poorly defined due to the thinness of the wall. Aperture, a low slit at the base of the apertural face.

Remarks. Skipp, in her original description, reports a slightly thicker wall. However, most of her original material is heavily oolitized and the wall thickness of the last coil is difficult to estimate; the penultimate coil of her material shows a considerably thinner spirotheca.

Stratigraphic range and distribution. Apparently a North American species. As emended and restricted here, Zeller's material is from Zone 8 of the Joana Limestone (bed 20 of the South Confusion Range section, Utah) and Skipp's material is from zones 8 and 9 of the Mooney Falls Member, Redwall Limestone, Arizona. In the Monkman Pass area, the species is encountered mainly in Zone 9 in the Shunda Formation.

Spinoendothyra recta (Lipina, 1955)

Plate 6, figs. 1-3

Endothyra recta (part) Lipina, 1955, p. 60, Plate 7, fig. 4 (not 5-8).

Plectogyra recta; Lipina, 1959, p. 33.

Plectogyra recta; Bogush and Yuferev, 1962, p. 130, Plate 3, fig. 6.

Endothyra recta; Rozovskaia, 1963, p. 27.

Plectogyra (Spinoendothyra) recta; Anonymous, 1963, p. 225.

Plectogyra recta; Conil and Lys, 1964, p. 211, Plate 35, figs. 709, 710.

Plectogyra (Spinoendothyra) recta; Ganelina 1966, p. 111, Plate 11, figs. 9, 10.

(not) *Plectogrya recta*; Brazhnikova et al., 1967, no description, Plate 8, fig. 6.

(not) *Plectogyra recta*; Conil and Lys, 1968, p. 521, Plate 9, fig. 119.

(not) *Plectogyra* aff. *recta*; Conil and Lys, 1968, p. 521, Plate 7, figs. 88-89.

(not) *Plectogyra recta*; Vdovenko, 1969, no description, Plate 1, fig. 21.

(not) *Endothyra recta*; Conil et al., 1969, p. 59-60, Plate 2, fig. 20.

Endothyra sp. no. 4 (part), Michelsen, 1971, p. 63, Plate 12, fig. 12 (only).

(not) *Endothyra recta*; Michelsen, 1971, p. 61-62, Plate 12, figs. 3-11, Plate 18, figs. 6-11, Plate 19, figs. 1-3.

(not) *Plectogyra recta* forma typica OBJ, infrasubspecific Brazhnikova and Vdovenko, 1971, p. 206, Plate 42, figs. 12-14, Plate 43, figs. 13, 14, 16, 17.

(not) *Plectogyra recta* forma graciosa OBJ, infrasubspecific, Brazhnikova and Vdovenko, 1971, p. 62, Plate 44, figs. 3, 4, 8.

?*Endothyra (Spinoendothyra) recta*; Brazhnikova and Vdovenko, 1973, (part), no description, Plate 18, fig. 8? (not 5).

(not) *Endothyra* aff. *recta*; Segura, 1973, p. 246, Plate 1, fig. 13.

Endothyra recta; Bozorgnia, 1973 (part), p. 65, Plate 9, figs. 3, 4 (not 5, 6).

(not) *Endothyra recta*; Conil and Lees, 1975, no description, Plate 3, fig. 31.

Endothyra (Spinoendothyra) recta; Grozdilova et al., in Stepanov et al., 1975, p. 35, Plate 4, fig. 16.

(not) *Endothyra* cf. *recta*; Conil and Naum, 1977, no description, Plate 7, fig. 89.

Spinoendothyra recta; Armstrong and Mamet, 1977, p. 66.

Endothyra (Spinoendothyra) recta; Conil in Groessens et al., 1977, (part), p. 32, Plate 1, fig. 14.

(not) *Endothyra (Spinoendothyra) recta*; Conil in Conil et al., 1977, no description, Plate 5, fig. 54.

Endothyra (Spinoendothyra) recta; Grozdilova and Lebedeva in Sultanaev et al., 1978, no description, Plate 3, fig. 14.

(not) *Endothyra* sp. forma recta OBJ, infrasubspecific, Brazhnikova in Aizenberg et al., 1979, no description, Plate 5, fig. 19.

(not) *Spinoendothyra recta*; Conil et al., 1980, no description, Plate 9, figs. 18-20, Plate 10, figs. 4-6.

Diagnosis. Test free, irregularly discoidal, compressed laterally, with umbilical depression. Form ratio 1: 0.45 to 0.5. Proloculus spherical, small, approximately 25 µm, followed by an oscillating spirotheca. Rate of expansion slow. Diameter for adult specimens having ten to eleven chambers in the last whorl, 500 to 640 µm. Exceptionally, twelve chambers in the last whorl. Average diameter 580 µm for four to four and one half whorls. Chambers are depressed, low, irregular, with poorly defined sutures. Septa irregular, anteriorly curved, at various angles from the spirotheca. Secondary deposits as resorbed spines. Wall calcareous secreted, differentiated in tectum/tectoria, 12 to 18 µm thick in the last chamber. Aperture, a low slit at the base of the apertural face.

Remarks. Lipina's original material should now be considered to belong to two genera. The holotype (similar to our material) is a *Spinoendothyra*, whereas the rest of the forms belong to *Inflatoendothyra* (see Armstrong and Mamet, 1977, p. 54 and 56). Since these genera coexist at the same stratigraphic level and in similar facies, the confusion is easily understandable.

Stratigraphic range and distribution. In the literature the taxon is reported from the upper Tournaisian and the lower Viséan. Reports from higher levels result from confusion with non-spinoendothyrid foraminifers and should be discarded. In the Monkman Pass area, the species is present in the Shunda Formation, the Unnamed unit, the Turner Valley Formation, and the lower part of the Mount Head(?) Formation. Most of the specimens come from Zone 9, with rare specimens present in Zone 10, and two exceptional examples from Zone 11.

Spinoendothyra costifera (Lipina in Grozdilova and Lebedeva, 1954)

Plate 6, figs. 4-7

Endothyra costifera Lipina in Grozdilova and Lebedeva 1954, p. 86, Plate 10, fig. 15 (designated as plesiotype "with the author's consent").

Endothyra costifera; Lipina, 1955, p. 60, Plate 7, figs. 9-11 (fig. 9 designated as holotype).

Plectogyra costifera; Lipina, 1959, p. 72.

Plectogyra costifera; Pronina, 1963, p. 136, Plate 3, figs. 9,10.

Plectogyra (Spinoendothyra) costifera; Anonymous, 1963, p. 225.

Endothyra costifera; Rozovskaia, 1963, p. 25.

Plectogyra (Spinoendothyra) costifera; Ganelina, 1966, p. 111-112, Plate 11, fig. 11.

Plectogyra costifera; Brazhnikova et al., 1967, p. 199, Plate 7, fig. 7.

Endothyra aff. *costifera*; Michelsen, 1971, (part), p. 55-56, Plate 9, fig.6 (not 5, 7).

Plectogyra costifera forma typica OBJ, infrasubspecific, Brazhnikova and Vdovenko, 1971, p. 204, Plate 41, figs. 2, 4.

Plectogyra ex. gr. *costifera*; Brazhnikova and Vdovenko, 1971, p. 204, Plate 41, figs. 1, 3).

Plectogyra costifera forma celsa OBJ, infrasubspecific, Brazhnikova and Vdovenko, 1971, p. 62, Plate 44, figs. 6, 7, Plate 41, figs. 1, 3.

?*Plectogyra costifera*; Malakhova, 1973, (part), p. 167, Plate 6, fig. 5 (not Plate 4, fig. 5).

Endothyra (Spinoendothyra) costifera; Brazhnikova and Vdovenko, 1973, Plate 17, fig. 30.

Endothyra (Spinoendothyra) costifera; Grozdilova, 1973, p. 87, Plate 5, figs. 7-8.

Endothyra (Spinoendothyra) forma minima OBJ, infrasubspecific, Brazhnikova and Vdovenko, 1973, Plate 17, figs. 24-26.

Endothyra (Spinoendothyra) costifera; Grozdilova et al. in Stepanov et al., 1975, p. 35, Plate 4, fig. 5.

Spinoendothyra costifera; Armstrong and Mamet, 1976, p. 13.

Spinoendothyra costifera; Armstrong and Mamet, 1977, p. 66, no description.

(not) *Spinoendothyra costifera*; Conil in Kimpe et al., 1978, no description, Plate 10, fig. 50.

?*Endothyra (Spinoendothyra) costifera*; Grozdilova and Lebedeva, in Sultanaev et al., 1978, no text, Plate 3, fig. 18.

Spinoendothyra sp. Conil et al., 1980, no description, Plate 3, fig. 25.

Diagnosis. Test free, irregularly discoidal, slightly compressed laterally. Form ratio 1: 0.5 to 0.6. Proloculus spherical, small, 20 to 30 µm. Coiling streptospiral throughout. Last whorl(s) are oscillating and become somewhat evolute. Rate of expansion very slow to slow. Eight to nine chambers, sometimes ten in the last whorl. Diameter 400 to 520 µm, exceptionally 550 µm, for three to three and one half whorls. Sutures poorly defined. Chambers low, irregular. Septa oblique, with ample variation of the slant. Secondary deposits as low, discrete, thick spines anteriorly curved. Resorption quite variable. Wall calcareous secreted, differentiated, 10 to 16 µm in the last whorl. Aperture, a low slit at the base of the apertural face.

Remarks. The same taxonomic problem that plagues *Spinoendothyra paracostifera* is encountered for this taxon. The plesiotype designated by Grozdilova and Lebedeva is different from Lipina's holotype. There are also slight discrepancies in the diagnosis. A very large proloculus is reported by Grozdilova and Lebedeva, but is nowhere apparent in their material. Lipina reports a very high aperture, normally unknown among spinoendothyrids and not detectable in her published material. To add to the confusion, Lipina herself admits very great variability, with a wall thickness varying from very thin to thick. Our material fits the description of her figures 10 and 11.

Stratigraphic range and distribution. Reported mostly from the upper Tournaisian of Europe and Asia (Kizel, Kosvinsk, $C_1^t d_1$, etc.). In the Monkman Pass area, the species is present in abundance in Zone 9 (Shunda Formation and Unnamed unit). Highest apparent occurrence is in the lowest Viséan, at the Shunda-Turner Valley contact.

Genus "*Globoendothyra*" as provisional taxon

"*Globoendothyra*" (?) *trachida* (Zeller, 1957)

Plate 6, fig. 8

Plectogyra trachida Zeller, 1957, p. 698, Plate 81, fig. 1.

Plectogyra sp. Zeller, 1957, no description, Plate 81, figs. 2, 3.

Endothyra spp. McKay and Green, 1963, no description, Plate 5, fig. 4.

Endothyra trachida; Skipp in McKee and Gutschick, 1969, (part), p. 208 (not) Plate 19, fig. 4, Plate 21, figs. 1-5, 11, 12, 14 (only).

"*Globoendothyra*" (?) *trachida*; Mamet, 1976, no description, Plate 12, fig. 3, Plate 15, fig. 1, Plate 16, fig. 4, Plate 17, figs. 3-5, 6, Plate 62, figs. 1, 2.

Diagnosis. Test free, discoidal, involute, slightly compressed laterally, with faint umbilici. Form ratio 1: 0.8. Proloculus small, spherical, approximately 30 to 40 µm, followed by an erratically coiled spirotheca. Last whorl oscillating. Adult specimens of three and one half volutions vary in diameter from 640 to 760 µm, and with four volutions, from 720 to 880 µm. Chambers variable, subglobular, irregular, delimited by heavy, massive, long, anteriorly curved septa. Seven to nine chambers in last volution, usually eight. Wall thick relative to the size, not differentiated, 30 to 40 µm in the last chamber. Secondary deposits as heavy nodes connected by floor deposits. Some septal thickening. Aperture low, a basal slit.

Remarks. Zeller (1957, Plate 81, fig. 1) published a single section of his new taxon. Skipp (in McKee and Gutschick, 1969) considered that the specimens illustrated by Zeller on

Plate 82, figs. 2 and 3, which came from the same bed (35) of the South Teton section, should be included in *trachida*, and her usage will be followed here. However, Skipp emended the taxon to include forms with thin walls and septa (e.g. her figures 6-10 of Plate 21). It is impossible to have a clear idea of Zeller's concept, because it was based on such restricted material. However, in this holotype, the septa and wall are quite massive, and we prefer to restrict the species to forms exhibiting that character. "*Plectogyra*" *trachida* is a taxonomic puzzle. It does not fit any described endothyrid genus. We have used the name "*Globoendothyra*" (?) for this taxon but we realize that true *Globoendothyra* does not occur below the Viséan, whereas *trachida*, which does not exhibit a diaphanotheca, is common in the upper Tournaisian. Only a gross morphological resemblance places *trachida* as an ancestral form of *Globoendothyra baileyi* (for discussion, see Skipp in McKee and Gutschick, p. 209).

Stratigraphic range and distribution. Upper Tournaisian to lower Viséan of North America. In the Monkman Pass area, it is quite abundant in Zone 9 (upper Tournaisian) of the Shunda Formation, and is progressively replaced by true *Globoendothyra* in the Viséan Turner Valley Formation. The same progressive replacement was described by Skipp from the Redwall Limestone of Arizona (see above).

"*Globoendothyra*" (?) *paratrachida* sp. nov. Mamet

Plate 6, figs. 9-13

Holotype: GSC 65768, Plate 6, fig. 11.

Diagnosis. Test free, subglobular, involute, slightly compressed laterally, with umbilical depressions. Form ratio 1: 0.7 to 0.8. Proloculus 30 to 40 µm, followed by an erratically coiled spirotheca. Adult specimens of three and a half to four volutions range from 660 to 840 µm. Chambers subglobular. Septa long, arcuate, at low angle from the spirotheca. Sutures well marked. Seven to eight chambers in the last whorl. Wall very thick, not differentiated, with probable inclusion of some agglutinated particles, 30 to 50 µm in the last chamber. Secondary deposits as very heavy, continuous floor covering with irregular projections. Aperture, a low slit.

Remarks. The new species is similar to "*Globoendothyra*" (?) *trachida* Zeller, but has more massive, heavy, secondary floor covers and a thicker wall. It also resembles *Plectogyra nevadaensis* Zeller (1957), which is however, more regular, has a larger proloculus, and does not have massive secondary floor covers. "*G.*" *trachida*, "*G.*" *paratrachida*, and *P. nevadaensis* have no diaphanotheca (occasionally some trace of minor agglutination is present) and do not fit any published generic description.

Stratigraphic range and distribution. Fairly abundant in the Monkman Pass area. Upper Tournaisian-lower Viséan. Shunda and Turner Valley formations.

Type of the new species. Plate 6, fig. 11.

Genus *Tuberendothyra* Skipp in McKee and Gutschick, 1969, *emend.* Mamet, 1976

Tuberendothyra tuberculata (Lipina 1948)

Plate 7, fig. 1.

Endothyra tuberculata Lipina, 1948, p. 253, Plate 19, figs. 1, 2.

Endothyra tuberculata; Grozdilova and Lebedeva, 1954, p. 84, Plate 10, fig. 7.

Endothyra tuberculata; Lipina in Lebedeva, 1954, p. 247, Plate 3, figs. 1, 2.

Chernyshinella tumulosa Lipina, 1955, p. 51, Plate 5, figs. 16-19.

(not) *Endothyra tuberculata*; Malakhova, 1956, p. 109, Plate 10, figs. 1, 2, 4, 5.

Endothyra superlata Malakhova, 1957, p. 7, Plate 2, figs. 2, 3.

Plectogyra tumula Zeller, 1957, (part), p. 697, Plate 79, fig. 12, Plate 82, figs. 16, 17.

Plectogyra sp. Zeller, 1957, no text, Plate 77, fig. 13.

Plectogyra tumula Woodland, 1958, (part), p. 798, Plate 102, fig. 13, Plate 101, figs. 12, 14, 15.

Plectogyra tuberculata; Lipina, 1959, p. 29.

Plectogyra tuberculata; Grozdilova and Lebedeva, 1960, p. 66, Plate 4, fig. 1.

Plectogyra tuberculata; Lebedeva in Kalfina, 1962, p. 106, Plate C, fig. 18.

Plectogyra tuberculata; Bogush and Yuferev, 1962, p. 140-141, Plate 4, figs. 8, 9.

Endothyra tumula (part) McKay and Green, 1963, p. 40, Plate 1, fig. 1, Plate 4, figs. 7, 9, 11.

Endothyra tuberculata; McKay and Green, 1963, p. 39, Plate 3, figs. 2, 4.

Endothyra tuberculata; Rozovskaia, 1963, p. 27.

Endothyra (*Latiendothyra*) *tuberculata*; Anonymous, 1963, p. 225.

Chernyshinella (*Chernyshinella*) *tumulosa* var. multicamerata OBJ, infrasubspecific, Lipina, 1965, p. 87, Plate 20, figs. 5, 6.

Chernyshinella (*Chernyshinella*) *tumulosa*; Lipina, 1965, p. 87, Plate 20, figs. 1-4.

Endothyra tuberculata; Bogush and Yuferev, 1966, p. 127-128, Plate 7, figs. 12, 13.

Chernyshinella tumulosa; Ganelina, 1966, p. 92, Plate 7, figs. 17, 18.

Chernyshinella tumulosa; Bogush and Yuferev, 1966, p. 138, Plate 8, figs. 17, 18.

Plectogyra tuberculata; Aizenberg et al., 1968, p. 137, Plate 1, figs. 4-6.

(not) *Tuberendothyra tuberculata*; Skipp in McKee and Gutschick, 1969, p. 213-214, Plate 19, figs. 13-22, Plate 20, figs. 18-29.

?*Tuberendothyra* aff. *T. tumulosa*; Skipp in McKee and Gutschick, 1969, p. 214, Plate 19, figs. 6, 7.

(not) *Chernyshinella tumulosa*; Solovieva, 1969, p. 13, Plate 2, fig. 21.

(not) *Endothyra tuberculata*; Bogush and Yuferev, 1970, p. 101, Plate 5, figs. 20, 21.

Chernyshinella (*Chernyshinella*) *tumulosa* var. tumulosa forma typica OBJ, infrasubspecific, Brazhnikova and Vdovenko, 1971, p. 168, Plate 23, fig. 7.

Chernyshinella (*Chernyshinella*) *tumulosa* var. tumulosa forma minima OBJ, infrasubspecific, Brazhnikova and Vdovenko, 1971, p. 41, Plate 24, figs. 17, 18.

Chernyshinella (*Chernyshinella*) *tumulosa* var. multicamerata OBJ, infrasubspecific, Brazhnikova and Vdovenko, 1971, p. 168, Plate 23, fig. 10.

Plectogyra tuberculata tuberculata forma compressa OBJ, infrasubspecific, Brazhnikova and Vdovenko, 1971, p. 63, Plate 44, figs. 9-11.

Plectogyra tuberculata tuberculata forma typica OBJ, infrasubspecific, Brazhnikova and Vdovenko, 1971, p. 206, Plate 42, figs. 2-4.

Endothyra (*Tuberendothyra*) *tuberculata*; Brenckle, 1973, p. 47, 48, Plate 6, figs. 1-4.

Chernyshinella tumulosa; Brenckle, 1973, p. 33, Plate 3, figs. 20-22.

Chernyshinella (*Chernyshinella*) *tumulosa*; Kondatrenko-Zavjalova, 1974, p. 12, Plate 2, figs. 8-10.

Chernyshinella (*Chernyshinella*) *tumulosa* var. multicamerata OBJ, infrasubspecific, Kondatrenko-Zavjalova, 1974, p. 15, Plate 2, figs. 11-13.

Endothyra (*Spinoendothyra*) *tuberculata*; Grozdilova et al. in Stepanov et al., 1975, p. 36, Plate 4, fig. 4.

?*Endothyra tuberculata*; Michno in Michno and Balakin, 1975, p. 35, Plate 5, figs. 1-4.

Tuberendothyra tuberculata; Mamet in Armstrong and Mamet, 1976, p. 12, no description.

Tuberendothyra tuberculata; Mamet, 1976, Plate 5, fig. 3, Plate 6, fig. 1, Plate 7, figs. 6-8, no description.

Endothyra (*Tuberendothyra*) *tuberculata*; Lipina, 1977, p. 13, Plate 1, figs. 8, 9.

Chernyshinella (*Nodochernyshinella*) *tumulosa*; Conil and Lys, 1977, p. 28.

?*Endothyra tuberculata*; Yuferev in Simakov, 1979, p. 23, Plate 2, fig. 4.

Diagnosis. Test free, irregularly discoidal, slightly compressed. Form ratio about 1: 0.5 to 0.7. Proloculus spherical, approximately 40 µm, followed by an irregularly coiled spirotheca. Diameter for adult specimens 400 to 510 µm. Five to six chambers in the last whorl. Early portion of the test tightly coiled; the last whorl expands more rapidly. Chambers globular. Septa long, curved, anteriorly directed, oblique, showing septal thickenings at the tip. Secondary deposits as broad, heavy hood, observed throughout the whole test. Wall calcareous secreted, 16-22 µm in the last chamber. Very poor differentiation in tectoria? Aperture a low slit at the base of the apertural face.

Remarks. The author is convinced that *Chernyshinella tumulosa* is a high, oblique cut of *Tuberendothyra tuberculata*. In the literature, the two species are often recorded from the same strata, and in the Shunda and Pekisko formations abundant material shows an apparent progressive gradation between the two taxa depending on the orientation of the section. Also, there are no secondary deposits in true *Chernyshinella*.

Stratigraphic range and distribution. The species is cosmopolitan and widespread in the middle and lower upper Tournaisian (Cherepet-Kizel of USSR, lower and middle Osage of the U.S.A.). In North America, the species first occurs at the top of Zone 7, "blossoms" in Zone 8 and disappears at the Zone 8/9 boundary. In the Monkman Pass area it is common in the Pekisko and Shunda formations.

Genus *Inflatoendothyra* Vdovenko, 1972

Inflatoendothyra parainflata (Bogush and Yuferev, 1970)

Plate 7, figs. 2-6

Endothyra parainflata Bogush and Yuferev, 1970, p. 70-71, Plate 5, figs. 6, 7.

Diagnosis. Test free, discoidal, laterally compressed. Form ratio 1: 0.4 to 0.55. Proloculus spherical, 30 to 40 µm, followed by a very tight irregularly coiled spire, then by a tight, oscillating coil, with a tendency to evolution in the last volution. Diameter 350 to 480 µm for adults of three and one half to four whorls. Chambers numerous, eleven to twelve in the last coil. Septa quite variable, apparently rather long, curved, thickened, with lateral corner fillings. Sutures poorly expressed. Wall, a differentiated tectum, 12 to 15 µm. Secondary deposits are variable, disconnected nodosities and residual spines.

Remarks. The taxon is quite similar to *Inflatoendothyra inflata* Lipina OBJ, an invalid, preoccupied species which probably comprises a variety of taxa, and which was temporarily placed by Armstrong and Mamet (1977) in the *Inflatoendothyra multicamerata* group. Considerable difficulty is encountered in deciphering the *Inflatoendothyra* phylogeny and taxonomy.

With its numerous chambers and tight coiling, *parainflata* is similar to "*Plectogyra*" *obtrita* of Conil and Lys (1964), but the shape of the septa is different.

Stratigraphic range and distribution. As reported in 1977 by Armstrong and Mamet, *Inflatoendothyra* is quite common and cosmopolitan at the Tournaisian-Viséan boundary. *Parainflata* (and its counterpart *inflata* OBJ) are abundant at the base of the Turner Valley Formation (Zone 10) and scarce in Zone 11. Armstrong and Mamet (1977) have previously shown that *Inflatoendothyra* forms the link between *Spinoendothyra* and *Dainella*. Our material of *parainflata* further suggests a link with primitive *Eoendothyranopsis*.

Genus *Paradainella* Brazhnikova and Vdovenko, 1971

Paradainella dainelliformis Brazhnikova and Vdovenko, 1971

Plate 6, figs. 7, 8

Paradainella dainelliformis forma typica OBJ, infrasubspecific; Brazhnikova and Vdovenko, 1971, p. 44-45, Plate 29, figs. 1-11, Plate 30, figs. 1-11.

Paradainella dainelliformis forma solida OBJ, infrasubspecific, Brazhnikova and Vdovenko, 1971, p. 45, Plate 31, figs. 1-6.

Paradainella sp. Mamet, 1976, no description, Plate 14, fig. 10.

Diagnosis. Test free, subglobular, involute, with a form ratio 1: 0.6 to 0.75. Proloculus spherical, 30 to 50 µm, followed by an erratic spirotheca. Rapid changes in the oscillations. Adult specimens of three and a half to four volutions, range in diameter from 480 to 600 µm. Number of chambers small, usually six to seven in the ultimate and penultimate coil. Septa long, highly variable. Secondary deposits as pseudochomata or massive double tumuli? Wall, a thick tectum, 20 to 30 µm in the last coil. Opening basal, a low slit.

Remarks. Brazhnikova and Vdovenko report a rather small proloculus, but most of their published material illustrates rather high sections. The few well centered figures show a rather large proloculus. Their report of the occurrence of agglutinated grains in the wall remain unconvincing.

A single *Paradainella* sp. was illustrated by Mamet (1976) from the Tournaisian/Viséan boundary in Alberta, where this taxon is very scarce. In the Monkman Pass area, an identical taxon is somewhat more abundant and allows the specific attribution to *dainelliformis*.

Stratigraphic range and distribution. Reported from the Donetz Basin as uppermost Tournaisian $C_1^td_1$ and scarce in the lower Viséan. Similar distribution in Canada, but quite scarce. In the Monkman Pass area, the taxon is present in the upper Tournaisian (Zone 9) in the Shunda Formation. It is very scarce in the lower Viséan.

Family GLOBOENDOTHYRIDAE Reitlinger, 1959

Genus *Dainella* Brazhnikova, 1962

Dainella cussyensis (Meunier, 1888)

Plate 7, figs. 9-11, 12?

Endothyra cussyensis Meunier, 1888, p. 235, figs. 5, 6?

"*Endothyra* (?) *chomatica* Dain, 1940, Plate 12, figs. 1-4", as reported by the Russian authors, OBJ, invalid, never published.

Dainella chomatica "Dain" *nom. trans.* forma typica OBJ, infrasubspecific; Brazhnikova, 1962, p. 23, Plate 10, fig. 9, Plate 11, figs. 1-3.

Dainella chomatica "Dain" *nom. trans.* forma magna OBJ, infrasubspecific, Brazhnikova, 1962, p. 24, Plate 11, figs. 4, 7, 8.

Dainella chomatica "Dain" *nom. trans.* forma staffelloides OBJ, infrasubspecific, Brazhnikova, 1962, p. 25, Plate 11, figs. 5, 6, 9.

Dainella chomatica Rozovskaia; 1963, p. 28.

Dainella sp. Conil and Lys, 1964, p. 149, Plate 21, figs. 430, 431.

Plectogyra pseudominuta var. fleronensis OBJ, infrasubspecific, Conil and Lys in Conil, 1964, no description, Plate 1, fig. 15.

Dainella chomatica forma typica OBJ, infrasubspecific, Conil and Lys, 1964, p. 149, Plate 21, fig. 429.

Plectogyra (?) *fleronensis* Conil and Lys, 1964, p. 186, Plate 29, figs. 569-574.

Plectogyra inflata var. analoga (part), OBJ infrasubspecific, Conil and Lys, 1964, p. 190, Plate 30, fig. 597 (only).

Dainella cussyensis; Mamet, 1967, p. 22-23.

Dainella ex. gr. *chomatica*; Brazhnikova et al., 1967, p. 199, Plate 8, fig. 4.

Dainella chomatica forma typica OBJ, infrasubspecific, Conil and Lys, 1967, no description, Plate 2, fig. 17.

Dainella florenensis (sic); Conil and Lys, 1968, p. 524, Plate 6, fig. 72.

Dainella chomatica; Postojalko, 1970, p. 123, Plate 35, figs. 1-3.

?*Dainella chomatica*; Bogush and Yuferev, 1970, p. 103, Plate 7, fig. 12.

Dainella uralica Postojalko, 1970, p. 127-128, Plate 36, figs. 1-3.

Dainella libera Postojalko, 1970, p. 130, Plate 36, figs. 9, 10.

Dainella ex. gr. *chomatica* Brazhnikova and Vdovenko, 1971, p. 184, Plate 31, figs. 12, 13.

Dainella chomatica; Postojalko, 1972, no description, Plate 3, figs. 4-6.

Dainella chomatica; Brazhnikova and Vdovenko, 1973, no description, Plate 13, figs. 2-4.

Dainella chomatica; Malakhova 1973, p. 14, Plate 3, figs. 2-4.

Dainella chomatica forma typica OBJ, infrasubspecific, Bozorgnia, 1973, p. 76-77, Plate 9, figs. 1-18.

Dainella chomatica forma staffelloides OBJ, infrasubspecific, Bozorgnia, 1973, Plate 11, figs. 13-15.

Dainella chomatica forma magna OBJ, infrasubspecific, Postojalko 1975, no description, Plate 23, figs. 1-3.

Dainella chomatica forma magna OBJ, infrasubspecific, Malakhova, 1975, p. 21, Plate 23, fig. 3.

Dainella libera; Simonova, 1975, p. 187, Plate 6, fig. 5.

Dainella uralica; Simonova, 1975, p. 188, Plate 6, figs. 7, 8.

Dainella chomatica; Grozdilova et al. in Stepanov et al., 1975, p. 32, Plate 3, fig. 7.

Dainella chomatica forma magna OBJ, infrasubspecific, Simonova, 1975, p. 188, Plate 6, fig. 10.

Dainella chomatica; Postojalko, 1975, no description, Plate 6, figs. 10, 11, 15, Plate 12, fig. 13.

Dainella chomatica; forma typica OBJ, infrasubspecific, Malakhova, 1976, p. 21, Plate 12, figs. 1, 2.

Dainella cussyensis; Dil, 1977, no description, Plate 4, fig. 68.

Dainella chomatica; Grozdilova and Lebedeva in Sultanaev et al., 1978, p. 121, Plate 3, fig. 15.

Diagnosis. Test free, subglobular, involute, slightly compressed, with feeble umbilical depressions. Form ratio 1: 0.60 to 0.85. Proloculus rather small (20-40 µm), followed by streptospiral coil. Coiling irregular, with very abrupt changes in coiling plane (up to 90°). Ten to thirteen chambers in last coil. Number of chambers varies greatly. Sutures faint. Septa long, at various angles from the spirotheca, some nearly straight. Chambers subquadratic with apparent great morphological variability, mostly due to abrupt coiling changes. Diameter of test ranges from 460 µm for adult forms of four whorls, to 650 µm for adult forms of five whorls. Wall two layered, a microcrystalline tectum with a poorly defined diaphanotheca. Thickness of wall 14 to 18 µm (rarely 20 µm) in the last whorl. Secondary deposits as disconnected double-hooked pseudochomata. Aperture, a low slit at the base of the apertural face.

Remarks. The taxon is highly variable. The different "varieties" recognized by the Russian authors are directly related to growth stages.

Stratigraphic range and distribution. A worldwide taxon characteristic of the Viséan. First occurs in Zone 10 and, therefore, is a reliable marker for recognition of the base of the Viséan. Common in the lower and middle Viséan. In the Monkman Pass area, the species is widespread in the Turner Valley and Mount Head(?) formations in zones 10 and 11, and less abundant in Zone 12.

Dainella dainae (Chernysheva, 1940)

Plate 7, fig. 14

Nanicella dainae Chernysheva, 1940, p. 127, Plate 1, figs. 6, 7, Table 1, fig. 1, (idealized).

Quasiendothyra (?) *intermedia* Brazhnikova, 1962, p. 21, Plate 10, figs. 10, 11.

Planoendothyra intermedia Anonymous, 1963, p. 224.

Plectogyra analoga var. versata OBJ, infrasubspecific, Conil and Lys, in Conil 1964, no description, Plate 1, fig. 16.

Plectogyra (?) *versata* Conil and Lys, 1964, p. 224, Plate 38, figs. 778-780.

Plectogyra (?) aff. *versata* Conil and Lys, 1964, p. 224, Plate 38, fig. 781.

(not) *Endothyra* (?) (*Spinoendothyra*) *versata* Brazhnikova and Vdovenko, 1973, no description, Plate 17, figs. 31, 33.

?*Dainella* Conil and Lees, 1975, no description, Plate 3, fig. 40.

Dainella dainae; Armstrong and Mamet, 1977a, p. 71, no description.

Diagnosis. Test free, compressed laterally, with poorly defined umbilici. Form ratio 1: 0.35 to 0.50. Proloculus 0.40 to 0.50 µm followed by erratic oscillating spirotheca. Penultimate and ultimate whorls nearly in the same plane, with a strong tendency to become evolute. Twelve to fourteen chambers in the last whorl (usually thirteen). Diameter 600 to 750 µm for adults with four to four and one half volutions. Chambers subquadratic, of variable apparent morphology as a result of the oscillating coil. Septa rather long, at variable angles from the spirotheca, some subperpendicular. Sutures faint. Wall, a tectum with an inconspicuous diaphanotheca, 20 to 25 µm in the last chamber. Secondary deposits well developed as dual pseudochomatal ridges. Aperture, a low slit at base of apertural face.

Remarks. Chernysheva's taxon has never been illustrated since its origin, probably because of the imperfect description, based essentially on the outside morphology and not including the internal structure. For instance, the report that the species has only two or three volutions is based on external morphology and does not account for the proloculus and streptospiral part.

The main characteristic of this *Dainella* is the evolute tendency of the coil(s), which oscillate nearly in the same plane. In its size and numerous chambers, the taxon is similar to *Dainella tujmasensis* (Vissarionova, 1948) and its various synonyms in the literature, such as *Plectogyra* (?) *exuberans* Conil and Lys (1964), which has the same stratigraphic range but appears to be more inflated in axial section and does not present a tendency to evolute uncoiling. The inclusion of the taxon among the "Loeblichiidae" by Conil et al., 1980 is unsupported.

Stratigraphic range and distribution. Reported from the lower and middle Viséan of Europe. Rare in the Monkman Pass area, first occurring at the Tournaisian/Viséan boundary and present at the base of the Turner Valley Formation (lower Viséan).

Genus *Globoendothyra* Reitlinger in Rauzer-Chernoussova and Fursenko 1959

Globoendothyra of the group *G. baileyi* (Hall, 1864)

Plate 10, fig. 8?, Plate 11, figs. 1-7

For synonymy see Armstrong and Mamet, 1977, and add:

Endothyra sp. Marchant 1975, no description, Plate 2, fig. 20.

Globoendothyra of the group *G. baileyi*; Mamet 1976, no description, Plate 15, fig. 1, Plate 17, fig. 7, Plate 64, fig. 4, Plate 62, figs. 1-4.

Diagnosis. Test free, subrounded, with very slight lateral compression and poor umbilici. Proloculus spherical, up to 60 µm in diameter, followed by an erratically coiled, involute spirotheca. Diameter 630 to 950 µm for adults of three and one half to four volutions; exceptionally 950 to 1100 µm for forms of four and one half volutions. Nine to eleven chambers in last volution. Septa endothyroid, curved forward, sometimes resorbed in the early coils, delimiting subglobular to globular chambers. Thickness 20 to 30 µm, at the spirotheca. Secondary deposits low, as floor covers, with prominent projection in last chamber. Trace of resorbed spines in last coil. Wall calcareous secreted. Tectum, a poorly defined diaphanotheca. Aperture, a low slit at base of the apertural face.

Remarks. As mentioned by Armstrong and Mamet (1977), the group is represented in the Cordilleran mostly by small forms with thin walls. The *baileyi* group quite possibly belongs to the new subgenus *Globoendothyra* (*Eogloboendothyra*) Vdovenko (1972). We consider that involute *Globoendothyra* with poorly defined diaphanotheca can reasonably be assigned to the eogloboendothyrids. However, the type of Vdovenko's subgenus (*Endothyra globulus* var. *parva* Chernysheva) is invalid, and the original description quite unclear and poorly illustrated. Although we recognize the potential usefulness of *Eogloboendothyra*, we will not use it until it is formally redefined.

Septal resorption is often observed in the group. This resorption is observable among all known endothyrids (from the Famennian quasiendothyrids to the Viséan endothyranopsids) and it should not be used as a generic criterion.

Stratigraphic range and distribution. Eurasia and North America. The most widespread *Globoendothyra* in early and early middle Viséan time. In the Monkman Pass area, it is very abundant in the Turner Valley and Mount Head(?) formations (zones 10, 11 and 12).

Globoendothyra of the group *G. tomiliensis* (Grozdilova in Lebedeva, 1954)

Globoendothyra paula (Vissarionova, 1948)

Plate 11, figs. 10-12

For synonymy, see Armstrong and Mamet, 1977 and add:

Globoendothyra paula; Mamet and Armstrong, 1972, p. C 133, fig. 4E.

(not) *Globoendothyra parva* Postojalko, 1972, no description, p. 12, Plate 2, figs. 7-8.

Globoendothyra (*Eogloboendothyra*) *parva*; Vdovenko, 1972, p. 108.

?*Endothyra* (*Globoendothyra*) *aequiparva* Brenckle, 1973, p. 45, Plate 5, figs. 5-8.

?*Globoendothyra parva*; Malakhova, 1973, p. 168, Plate 8, figs. 3-5.

?*Globoendothyra* (*Eogloboendothyra*) *parva* var. ukrainica OBJ, infrasubspecific, Brazhnikova and Vdovenko, 1973, p. 197, Plate 25, figs. 1, 2, 4.

Globoendothyra paula; Armstrong and Mamet, 1975, no description, p. 13, fig. 10 "B" (=H).

?*Globoendothyra parva*; Malakhova, 1975, p. 27, Plate 16, figs. 1-5.

(not) *Globoendothyra parva*; Postojalko, 1975, p. 119, Plate 4, fig. 23, Plate 5, fig. 11, Plate 10, fig. 15, Plate 19, fig. 8.

Globoendothyra parva; Michno in Michno and Balakin, 1975, p. 40, Plate 7, figs. 8-9.

Globoendothyra paula; Mamet, 1976, no description, Plate 25, fig. 3, Plate 26, figs. 3, 4, Plate 29, fig. 2, Plate 33, figs. 2-4, Plate 34, figs. 2, 3, Plate 36, figs. 1-4, Plate 44, fig. 2, Plate 52, fig. 3, Plate 66, fig. 2, Plate 67, figs. 1-4, Plate 85, fig. 6, Plate 90, figs. 1, 2, Plate 91, figs. 3-4, Plate 92, figs. 1, 2.

Globoendothyra parva; Grozdilova and Lebedeva in Sultanaev et al., 1978, p. 121, Plate 5, fig. 2.

Globoendothyra paula; Bamber and Mamet, 1978, Plate 2, figs. 1, 2, Plate 4, fig. 4.

Endothyra (*Globoendothyra*) *paula*; Rich, 1980, p. 24, Plate 8, fig. 14, Plate 9, fig. 13.

Diagnosis. Test free, subglobular, laterally compressed, with poor umbilici. Proloculus small, followed by an erratically coiled, rapidly expanding spirotheca. Diameter of adult specimens of three and one half to four and one half whorls, 600 to 800 µm with an average of 700 to 720 µm. Width 500 to 650 µm. Form ratio about 1: 0.7 to 0.8. Chambers subrounded, seven or eight in the last whorl, exceptionally nine. Sutures marked. Septa endothyroid, curved, medium to long. Wall thickness in the last whorl 25 to 30 µm. Secondary deposits as low continuous floor covers with spinose projection in the last chamber. Wall, a tectum with a well defined diaphanotheca. Aperture, a low basal slit.

Stratigraphic range and distribution. The most widespread, cosmopolitan *Globoendothyra* in middle and late Viséan time. Scarce in the Namurian (see Armstrong and Mamet, 1977, for details). In the Monkman Pass area, appears for the first time in middle Viséan Zone 12 [Mount Head(?) Formation].

Family GLOBOENDOTHYRIDAE? Reitlinger, 1959

Genus *Skippella* Mamet, 1974

Skippella fellersi sp. nov.

Plate 9, figs. 4-11, Plate 10, figs. 2-3,
Plate 11, fig. 8

Holotype: GSC 65810, Plate 10, fig. 2.

?*Eomillerella spiroides* (part) Skipp in McKee and Gutschick, 1969, p. 221-222, Plate 27, fig. 10 (only).

Diagnosis. Test free, discoidal, laterally compressed, with well defined umbilical depressions. Proloculus, about 50 to 60 µm, followed by two or three erratic coils. Last two or three coils regular, planispiral, involute, with a tendency to evolution in the last whorl. Diameter 770 to 1200 µm, with an average of 1020 µm. Form ratio 1: 0.20 to 0.3. Expansion of the spirotheca in two parts: erratic, tight, glomospiral part; planispiral part moderate, then rapid in the last whorl. Chambers irregularly quadratic, with septa at 60° to 70° from the spirotheca. Number of chambers in the last whorl eleven to twelve, exceptionally thirteen. Secondary deposits well developed as anteriorly curved pseudochomatal ridges or spines. Wall calcareous secreted, 20 to 30 µm in the last chamber, with a poorly defined diaphanotheca. Pores present. Aperture, a low slit at the base of the apertural face.

Remarks. Differs from *Skippella arctata* (Conil and Lys, 1964) by abrupt coiling deviation, pronounced lateral compression and more strongly developed secondary deposits. *Skippella staffelliformis* (Chernysheva, 1948), *Skippella staffeliformis donica* (Brazhnikova and Rostovceva, 1967) (including the invalid "varieties" "evoluta" OBJ Brazhnikova and Rostovceva, 1967, "lata" OBJ Brazhnikova and Rostovceva, 1967, and "typica" OBJ Brazhnikova and Rostovceva, 1967), *Skippella juliusi* (Voizekhovskaia, 1961) and *Skippella transita magna* (Voizhekovskaia, 1961) are heavier, have a higher form ratio and rounder periphery. *Skippella flatile* (McKay and Green, 1963) displays a much more rapid expansion of the spirotheca. Finally *Skippella hamula* of Woodland (1958) has fewer chambers and exhibits a much more rapid expansion of the coil. In axial section, the new species shows some similarity to "*Parastaffella rara*" as illustrated by Lebedeva (1954), but is considerably bigger, has more irregular early coils, more highly developed secondary deposits, and many more chambers. The genus *Ninella*, published by Malakhova in 1975 (based on *E. staffeliformis* Chernysheva), appears to be partly equivalent to *Skippella* (Mamet, 1974). The new species *Ninella asiatica* Malakhova (1975) appears to be quite heterogeneous. Plate 23, figs. 1-6 shows examples of both *Skippella* and *Dainella*.

Stratigraphic range and distribution. Very abundant in the Turner Valley Formation and the lower Mount Head(?) Formation (zones 10 and 11). Rare in Zone 12. Skipp (1969) illustrated a taxon from the lower Viséan (lower Meramec) Mooney Falls Member of the Redwall Limestone from Bridge Canyon, Arizona, which is conspecific(?) with the Canadian material or very similar to it.

Type of the new species. Plate 10, fig. 2.

Genus *Eblanaia* "Conil and Marchant" in Conil, 1977

Eblanaia michoti michoti (Conil and Lys, 1964)

Plate 10, fig. 4, Plate 11, fig. 9

Plectogyra michoti Conil and Lys, 1964, p. 194-195, Plate 31, fig. 621.

Endothyra michoti spinata (part) Michelsen, 1971, p. 59-60, Plate 11, fig. 3 (only).

Spinotournayella ? *michoti*; Malpica, 1973, p. 225-226, Plate 1, figs. 1-4.

Spinotournayella ? aff. *michoti*; Marchant, 1975 (part) p. 460, Plate 1, figs. 8-10 (not 6).

?*Spinotournayella* ? cf. *michoti*; Marchant, 1975, (part), Plate 2, fig. 15?

Spinotournayella ? *michoti*; Marchant, 1975, p. 458, 460, Plate 2, figs. 13, 14, 19, Plate 3, fig. 22.

cf. *Brunsiina* Marchant, 1975, Plate 2, fig. 7.

Spinotournayella ? *michoti*; Conil and Lees, 1975, no description, Plate 1, figs. 7-12, Plate 3, fig. 33.

Eblanaia michoti; Conil and Lys, 1977, p. 30-31, Plate 4, figs. 72-74, Plate 5, figs. 76-77, Plate 6, fig. 100.

Eblanaia michoti; Conil, 1977, p. 472, no text, Plate 1, figs. 4, 8, 9.

Eblanaia michoti subsp. 1, Conil, 1977, p. 472, no text, Plate 1, figs. 1-3.

Eblanaia michoti subsp. 2, Conil, 1977, p. 472, no text, Plate 1, fig. 10.

cf. *Eblanaia* sp. 1, Conil et al., 1980, no description, Plate 1, figs. 4-6.

Eblanaia michoti; Conil et al., 1980, no description, Plate 3, figs. 9?-10?, Plate 5, fig. 25?, Plate 6, figs. 1-5.

Diagnosis. Test free, discoidal, laterally compressed. Form ratio 1: 0.3. Umbilici depressed. Proloculus round, large, up to 80 µm, followed by a slightly streptospiral spirotheca, and then by a rather regular evolute symmetrical coil. Diameter for four to five whorls, 700 to 1100 µm, exceptionally up to 1250 µm. Rate of expansion slow in the early coils, then progressively rapid. Periphery rounded. Eight to nine chambers in the last volution for adult specimens. Initial septa (in the glomospiral part), blunt, resorbed, at low angle from the spirotheca and of tournayellid aspect. Septa become progressively more pronounced, anteriorly curved, forming subglobular chambers in the last coil. Secondary deposits as low spines, connected by thin floor cover. Some septal thickening and corner filling. Last chamber has hook or a spine. Wall dark, a secreted tectum, commonly with a recrystallized diaphanotheca. Wall progressively thickens and reaches 30 to 35 µm in the last volution. Aperture, a low slit at the base of the apertural face.

Remarks. Original description by Conil and Lys (1964) and further comments on the genus by the same authors mention an agglutinated wall. Published photographs of the species and our material show a thick, recrystallized diaphanotheca very similar to that observed in *Globoendothyra*. Axial sections of *Eblanaia* show the evolute coil, and thus are easy to differentiate from *Globoendothyra*. High equatorial or high oblique sections do not clearly show this character and the two genera are sometimes difficult to separate. The inclusion of the genus among the Chernyshinellinae by Conil et al., 1980 appears, therefore, quite doubtful.

Stratigraphic range and distribution. Uppermost Tournaisian?-lower Viséan of Europe. In the Monkman Pass area, the species occurs mainly in the basal part of Zone 10 at the Shunda-Turner Valley contact. It is less abundant in the lower Mount Head(?) Formation (Zone 11).

Eblanaia michoti spinata (Michelsen, 1971)

Plate 10, figs. 5-7

Endothyra michoti spinata (part) Michelsen 1971, p. 59-60, Plate 11, figs. 1, 2, 4, 5, 6, Plate 12, fig. 1.

Eblanaia spinata Conil and Lys, 1977, Plate 5, fig. 77 (reproduction of Michelsen's holotype).

Diagnosis. Test free, discoidal, laterally compressed. Form ratio 1: 0.3 to 0.4. Umbilici depressed. Proloculus spherical, prominent, 60 to 70 µm, followed by a slightly streptospiral spirotheca, then by a rather regular, evolute, symmetrical coil. Diameter for five whorls, 800 to 1000 µm, up to 1200 µm for six whorls. Rate of expansion low in the glomospiral coil and then moderate and progressive. Periphery round. Eight to ten chambers in the last whorl for mature specimens. Initial septa tournayellid, blunt, resorbed(?), at low angle from the spirotheca. Progressive enlargment of the septa which form subglobular chambers in the last whorl. Secondary deposits as spine or hook in the last chamber, residual spines interconnected with floor cover, septal thickenings at the tip, and corner fillings. Wall, a tectum with recrystallized diaphanotheca. Wall thickness reaches 30 to 45 µm in the last coil. Aperture, a low slit.

Remarks. The two subspecies *michoti* and *spinata* are nearly identical. According to Michelsen, his new subspecies differed from the typical *michoti* material by its greater diameter. This is not substantiated by our material. In addition, the material of Conil and Lees (1975) from Ireland shows great variation in the streptospiral coil, ranging from negligible to very prominent. As both subspecies are encountered at the same level, it is possible that they should be reunited; if more *michoti-spinata* associations are observed at the same level in other basins of the world, they should be considered as intraspecific variants.

Stratigraphic range and distribution. Reported from the lower Viséan of Europe. In the Monkman Pass area, the taxon has the same range and distribution as *E. michoti michoti*.

Family PSEUDOENDOTHYRIDAE Mamet in Mamet, Mikhailov and Mortelmans, 1970

Genus *Eoparastaffella* Vdovenko, 1954

Eoparastaffella simplex Vdovenko, 1954

Plate 7, fig. 13

Eoparastaffella simplex Vdovenko, 1954, p. 64-66, Plate 1, figs. 1-2.

Eoparastaffella pseudochomata Vdovenko, 1954, p. 66-67, Plate 1, figs. 5-6.

Eoparastaffella simplex forma typica OBJ, infrasubspecific, Vdovenko, 1964, p. 26, Plate 2, figs. 1-10.

Eoparastaffella simplex forma pseudochomata OBJ, infrasubspecific, Vdovenko, 1964, p. 27-28, Plate 1, figs. 4-6, Plate 2, fig. 11.

Eoparastaffella simplex forma typica OBJ, infrasubspecific, Vdovenko, 1969, p. 35-40, Plate 1, figs. 7, 27.

Eoparastaffella simplex forma typica OBJ, infrasubspecific, Popova, 1970, p. 134, Plate 37, figs. 1-7.

Eoparastaffella (Eoparastaffella) simplex forma lata OBJ, infrasubspecific, Vdovenko, 1971, p. 11, Plate 2, figs. 1-3.

Eoparastaffella (Eoparastaffella) simplex forma minima OBJ, infrasubspecific, Vdovenko, 1971, p. 12, Plate 2, figs. 16-17.

Eoparastaffella simplex forma typica OBJ, infrasubspecific, Postojalko, 1972, no text, Plate 4, figs. 6-9.

Eoparastaffella iniqua Postojalko, 1972, p. 5-6, Plate 4, figs. 10-12.

Eoparastaffella lenticulare Postojalko, 1972, p. 6-7, Plate 4, figs. 15-17.

Eoparastaffella (Eoparastaffella) simplex Brazhnikova and Vdovenko, 1973, no description, Plate 33, figs. 1-3.

Eoparastaffella simplex; Malakhova, 1973, p. 166, Plate 3, fig. 3?, Plate 8, figs. 1?, 2.

Eoparastaffella simplex forma typica OBJ, infrasubspecific, Bozorgnia, 1973, p. 146-147, Plate 8, figs. 6, 7, 13.

Eoparastaffella simplex forma typica OBJ, infrasubspecific, Postojalko, 1975, no description, Plate 7, figs. 6-9, Plate 13, figs. 13-15, Plate 23, figs. 4, 7-12, Plate 24, figs. 3-4.

Eoparastaffella simplex forma pseudochomata OBJ, infrasubspecific, Postojalko, 1975, no description, Plate 13, figs. 16-17, Plate 23, fig. 14.

Eoparastaffella simplex forma lata OBJ, infrasubspecific, Postojalko, 1975, no description, Plate 24, figs. 1-2.

Eoparastaffella iniqua Postojalko, 1975, no description, Plate 7, fig. 17, Plate 24, fig. 8.

Eoparastaffella lenticulare Postojalko, 1975, no description, Plate 7, figs. 29-30.

Eoparastaffella simplex; Conil and Lees, 1975, (part), p. 466, Plate 1, fig. 2 (only).

Eoparastaffella simplex forma typica OBJ, infrasubspecific, Simonova, 1975, p. 22-25, Plate 12, figs. 22-25.

Eoparastaffella simplex; Malakhova, 1975, p. 32, Plate 23, figs. 7-9, Plate 24, figs. 1-4.

Eoparastaffella simplex; Marchant, 1975, no description, p. 458, Plate 4, figs. 32-33.

Eoparastaffella simplex; Grozdilova et al. in Stepanov et al., 1975, p. 40, Plate 6, fig. 7.

Eoparastaffella simplex; Conil in Conil et al., 1977, no description, Plate 5, fig. 68.

Eoparastaffella simplex; Conil and Naum, 1977, no description, Plate 8, fig. 103.

Eoparastaffella simplex; Conil et al., 1980, no description, Plate 6, figs. 21?, 22, not Plate 9, fig. 8.

Diagnosis. Test free, discoidal, involute, symmetrical, unkeeled, with poorly expressed symmetrical umbilici. Form ratio 1: 0.5 to 0.6. Proloculus, 25 to 35 µm (sometimes as much as 45 µm); followed by a tight erratic first coil, then by two or three rapidly expanding planispiral coils. Diameter, 400 to 620 µm with an average of 500 µm for three and one half to four whorls. Chambers numerous, up to thirteen or fourteen in the last whorl, subquadratic, with ample morphological variation. Septa long, quite straight, at 70° to 80° from the spirotheca. Secondary deposits as anteriorly curved, massive pseudochomata. Wall, a differentiated tectum, with a thin diaphanotheca, 15 to 20 µm. Aperture, a low slit at base of apertural face.

Remarks. As the pseudochomatal ridges are discontinuous and sharply curved, the species appears, in a series of random sections, to have no secondary deposits at all, or quite the opposite, to have ridges with a tunnel. These extremes are confusing. *Eoparastaffella* is a pseudoendothyrid, not a true fusuline. In addition, the presence of a diaphanotheca indicates that the inclusion of the taxon in the Ozawainellidae by Conil et al., 1980 is unsupported.

Stratigraphic range and distribution. Reported from the lower and middle Viséan of Eurasia and North America. Abundant in zones 10, 11, and 12. In the Monkman Pass area, the taxon is scarce in zones 11 and 12 in the Mount Head(?) Formation.

Eoparastaffella ovalis Vdovenko 1954

Plate 8, figs. 1-9

Eoparastaffella ovalis; Vdovenko, 1954, p. 66, Plate 1, figs. 3-4 (immature form).

Eoparastaffella simplex forma ovalis OBJ, infrasubspecific; Vdovenko, 1964, p. 27, Plate 1, figs. 1-3, 7-9.

(not?) *Eoparastaffella simplex* forma ovalis OBJ, infrasubspecific; Vdovenko, 1969, p. 35-40, Plate 1, fig. 28.

Eoparastaffella (*Eoparastaffella*) *simplex* forma grandis OBJ, infrasubspecific, Vdovenko, 1971, p. 11, Plate 2, figs. 4-5.

Eoparastaffella (*Eoparastaffella*) *simplex* forma ovalis OBJ, infrasubspecific, Vdovenko, 1971, p. 11, Plate 2, figs. 9-13.

(?)*Eoparastaffella simplex* forma ovalis OBJ, infrasubspecific, Postojalko, 1972, no text, Plate 4, figs. 1-3.

Eoparastaffella lenevkensis Postojalko, 1972, no text, Plate 4, figs. 18-20.

Eoparastaffella (*Eoparastaffella*) *simplex* forma ovalis OBJ, infrasubspecific, Brazhnikova and Vdovenko, 1973, no description, Plate 33, figs. 4-7.

(?)*Eoparastaffella* (*Eoparastaffella*) *simplex* forma evoluta OBJ, infrasubspecific, Brazhnikova and Vdovenko, 1973, no description, Plate 33, figs. 8-10.

Eoparastaffella simplex forma ovalis Bozorgnia 1973, p. 147, Plate 8, fig. 8 (only).

Eoparastaffella lenevkensis Postojalko 1975, no description, Plate 7, figs. 19-21.

(not?) *Eoparastaffella simplex* forma ovalis OBJ, infrasubspecific, Postojalko, 1975, no description, Plate 7, figs. 1-3, Plate 13, figs. 7-8.

Eoparastaffella simplex forma evoluta OBJ, infrasubspecific, Postojalko, 1975, no text, Plate 23, fig. 13.

Eoparastaffella restricta laciniosa Postojalko, 1975, p. 124, Plate 24, figs. 6, 7.

Eoparastaffella simplex forma ovalis OBJ, infrasubspecific, Simonova, 1975, no text, p. 190-191, Plate 8, fig. 13.

(not) *Eoparastaffella simplex* forma ovalis OBJ, infrasubspecific, Pelhate and Poncet, 1975, p. 70, no text, Plate 1, figs. 8-9.

Eoparastaffella of the group *E. ovalis*; Mamet, 1976, no text, Plate 71, figs. 1-3.

Diagnosis. Test free, discoidal, involute, symmetrical, unkeeled, with symmetrical umbilici? Form ratio 1: 0.4-0.5. Proloculus, 30 to 40 µm (exceptionally as much as 50 µm) followed by two tight coils, then a loose, planispiral, involute spirotheca. Diameter, 400 to 550 µm for individuals of three to three and one half whorls and 500 to 760 µm for individuals of three and one half to four and one half whorls. Chambers numerous, subquadratic, up to thirteen or fourteen in the last whorl. Septa long, nearly straight, at 70° to 80° from the spirotheca. Secondary deposits as massive pseudochomata. Wall, a differentiated tectum, with a thin diaphanotheca, 15 to 20 µm. Aperture, a low slit at the base of the apertural face.

Remarks. American forms consistently appear larger than their Russian counterparts. However, Postojalko's work (1975) clearly shows that the range of *ovalis*, originally estimated by Vdovenko (diameter 300-500 µm for three to three and one half whorls), must be extended to include forms of four to four and one half whorls which range up to 760 µm. These artifical "forms" and "varieties" are found at the same stratigraphic level and have little paleontological credibility and no taxonomic validity.

Stratigraphic range and distribution. Reported in Eurasia from the lower and middle Viséan. Same distribution in Canada. In the Monkman Pass area, the taxon is abundant in zones 11 and 12 in the Mount Head(?) Formation.

Family ENDOTHYRANOPSIDAE Reitlinger, 1959

Genus *Eoendothyranopsis* Reitlinger and Rostovceva, 1966

Eoendothyranopsis spiroides (Zeller, 1957)

Plate 8, figs. 10, 11

For synonymy, see Armstrong and Mamet, 1977, p. 76 and add:

(not) *Eoendothyranopsis* cf. *E. spiroides*; Brenckle, 1973, p. 50, Plate 6, fig. 6.

Eoendothyranopsis spiroides; Mamet, 1976, Plate 23, figs. 1-4, Plate 43, figs. 9, 11, Plate 61, figs. 2, 3, Plate 62, figs. 1-4, Plate 64, figs. 1-4.

Diagnosis. Test free, discoidal, laterally compressed. Umbilici marked. Form ratio 1: 0.5. Proloculus small, round, 30 to 40 µm, followed by a planispiral involute spirotheca. Diameter 350 to 700 µm. In the Monkman Pass region, 540 µm is the average. Number of volutions, four to five, usually four and one half. Periphery subrounded. Slow expansion of the coil. Eleven to thirteen chambers in the last coil, exceptionally as many as fourteen. Septa of moderate length, 70° to 80° from the spirotheca. Wall, a tectum with a poorly defined diaphanotheca, 15 to 20 µm in the last chamber. Basal deposit a curved projection in the last chamber with traces of residual spines in the ultimate whorl. Aperture, a low slit at the base of the apertural face.

Remarks. Conil and Lees (1975) have illustrated (Plate 2, fig. 15) a form assigned to the "Tournayellidae" from the lower Viséan of Ireland, that is probably a recrystallized *Eoendothyranopsis* related to the *spiroides* group.

Stratigraphic range and distribution. Fairly abundant in the Salem Limestone and its stratigraphic counterparts in the North America Cordillera (zones 10 to 12). In the Monkman Pass area, the species is questionably present in Zone 10 (Turner Valley Formation) and abundant in zones 11 and 12 [Mount Head(?) Formation].

Eoendothyranopsis hinduensis (Skipp in McKee and Gutschick, 1969)

Plate 8, figs. 2, 13, Plate 9, figs. 1-3
Plate 10, fig. 1

For synonymy, see Armstrong and Mamet, 1977 and add:

Eoendothyranopsis hinduensis; Armstrong and Mamet, 1972, p. C133, fig. 4B.

Eoendothyranopsis hinduensis; Mamet, 1976, Plate 63, figs. 1-3, Plate 64, figs. 1-3, Plate 65, figs. 1-4 and Plate 72, fig. 6.

Diagnosis. Test free, discoidal, compressed laterally, with well marked umbilici. Form ratio approximately 1: 0.4-0.5. Proloculus spherical, 20 to 45 µm, followed by a planispiral, completely involute spirotheca. Diameter 700 to 1000 µm for four to five volutions. Adults of six volutions can achieve diameter of 1300 µm. Rate of uncoiling moderate, with slight expansion of the last spire. Chambers, usually twelve to thirteen in the last volution. In forms of six whorls, thirteen to fourteen (rarely fifteen). Septa of moderate length, anteriorly directed, 70° to 80° from the spirotheca. Wall, a tectum with poorly preserved diaphanotheca, 16 to 28 µm in the last whorl. Secondary deposits, one strong single spine in the last chamber. Some resorbed residual spines in the last whorl. Aperture, a low simple slit at the base of the apertural face.

Remarks. The sample figured on Plate 8, fig. 13 comes from Zone 12, has a more rapid expansion of the spire than a typical *hinduensis*, and therefore is gradational with the group *rara*, which first occurs at the Zone 12/13 boundary.

Stratigraphic range and distribution. Apparently endemic to North America. Quite abundant in the upper part of the Salem and its time equivalents in the North American Cordillera. In the Monkman Pass area, the taxon is observed for the first time in Zone 11 and it becomes quite abundant in Zone 12, with "giant" representatives.

Phylum CHLOROPHYCOPHYTA

Family CODIACEAE? (Trevisan) Zanardini, 1843 or DASYCLADACEAE? Kützing, 1843

Genus *Orthriosiphon* Johnson and Konishi, 1956

Orthriosiphon saskatchewanensis Johnson and Konishi, 1956

Plate 12, figs. 1-2

Orthriosiphon saskatchewanensis Johnson and Konishi, 1956, p. 99, Plate 2, figs. 1-3, Plate 5, figs. 1-7.

Orthriosiphon saskatchewanensis; Petryk and Mamet, 1972, p. 775, Plate 2, figs. 1-7, Plate 3, figs. 1-3.

Orthriosiphon aff. *saskatchewanensis*; Mamet and Rudloff, 1972, p. 85, Plate 4, fig. 11.

Orthriosiphon saskatchewanensis; Mamet, 1976, Plate 16, figs. 1, 2, Plate 17, figs. 1, 2, Plate 21, fig. 1, Plate 24, fig. 3.

Diagnosis. Thallus club-shaped, large, with thick medulla and a thick, poorly calcified outer cortex. Dichotomous tubes (20-40 µm in diameter) diverge slowly two or three times near the medulla. Tubes terminate as small funnels (60-80 µm) at the outer periphery. Conceptacles subspherical, prominent, irregularly arranged.

Remarks. Johnson and Konishi (1956) originally reported that the tubes ended as small funnels. However, this very characteristic shape was not clearly visible in their illustrations. It is also not apparent in figures subsequently published by Petryk and Mamet (1972) and Mamet and Rudloff (1972). *Orthriosiphon* is poorly calcified, the tubes preserved only as a result of micritization, and the outer periphery of the cortex often abraded. Our Plate 13, fig. 2 clearly shows the termination of the tubes as funnels.

Stratigraphic range and distribution. Total range upper Tournaisian to upper(?) Viséan, North American Cordillera. In the Monkman Pass area, first occurrence in the upper part of the Shunda Formation (Zone 9), widespread in zones 10, 11, and 12 in the Turner Valley and Mount Head(?) formations.

Family CODIACEAE (Trevisan) Zanardini, 1843

Genus *Ortonella* Garwood, 1914

Ortonella tyrrelensis Mamet and Rudloff, 1972

Plate 12, fig. 3

Ortonella tyrrelensis Mamet and Rudloff, 1972, p. 81, Plate 1, figs. 7-8.

Diagnosis. Hemispherical nodules, reaching 2 to 4 µm, composed of loosely packed, thick, cylindrical tubes (diameter 40-60 µm). Tubes are slightly wavy and micritization heavy. Angle of ramification variable – 20° to 40°.

Remarks. This species differs from typical *Ortonella* by having slightly wavy tubes, somewhat reminiscent of *Mitcheldeania*.

Stratigraphic range and distribution. The type of the species is from the upper Tournaisian Shunda Formation of Alberta. In the Monkman Pass area, the taxon is quite abundant in the Shunda Formation and in the Unnamed unit (late Tournaisian based on foraminiferal evidence).

Ortonella coloradoensis Johnson, 1945

Plate 12, figs. 4-5

Ortonella coloradoensis Johnson, 1945, p. 840, Plate 2, fig. 2.

Ortonella coloradoensis; Johnson and Konishi, 1956, p. 95, Plate 4, figs. 1-2.

Ortonella coloradoensis; Petryk and Mamet, 1972, p. 773-774, Plate 1, figs. 8-10.

Diagnosis. Radiating codiacean, forming prominent nodular masses, reaching 3 to 5 µm in diameter. Tubes regular, closely packed, with an internal diameter of 20 to 30 µm. Walls dark, heavily micritized, about 8 to 12 µm. Dichotomy variable. Some very regular, at rather low angle. Some appear much more irregular.

Stratigraphic range and distribution. Lower Carboniferous, North America. In the Monkman area, it is apparently upper Tournaisian. Quite abundant in the lagoonal facies of the Shunda Formation and present in the Unnamed unit.

Genus *Pseudohedstroemia* Mamet and Roux, 1978

Pseudohedstroemia polyfurcata Mamet and Roux, 1978

Plate 12, fig. 10

Pseudohedstroemia polyfurcata Mamet and Roux, 1978, p. 71, Plate 2, figs. 1-5, Plate 7, fig. 16.

Diagnosis. A heavily encrusting nodular codiacean, similar to *Hedstroemia*, but composed of two groups of bifurcating tubes. The first group is composed of thick, irregularly dichotomous tubes, reaching up to 100 to 120 µm in diameter. It contains a second group of thinner tubes ranging from 20 to 40 µm. Angle of dichotomy variable, for both categories of tubes.

Remark. The tubes are often dissolved, and the nodules are usually encountered as a mass of irregular, radiating geodes.

Stratigraphic range and distribution. Common in the lagoonal facies of the Shunda Formation (foraminifers indicate zones 8 and 9). Some nodules in the Unnamed unit (mainly in Zone 9). Original material comes from the middle Viséan of Tennessee.

Family DASCLADACEAE Kützing, 1843

Genus *Kamaena* Antropov, 1967

Kamaena itkillikensis Mamet and Rudloff, 1972

Plate 12, figs. 7-8

"*Nodosinella*" Aizenberg and Brazhnikova, 1966, Plate 22, figs. 10, 11?

Kamaena itkillikensis Mamet and Rudloff, 1972, p. 87, Plate 5, figs. 22-23.

Kamaena itkillikensis; Mamet and Roux, 1974, p. 141, Plate 1, figs. 1-6.

Diagnosis. Thallus cylindrical, regular, tiny. Cortex reaches 60 to 125 µm in diameter. Medulla divided by regular, thin partitions. Cortex thin, ranging from 4 to 15 µm in thickness (usually 8-10 µm). Pores extremely small. Medular cavity rectangular, the height half of the width. Conceptacles(?) spherical.

Stratigraphic range and distribution. Lower Carboniferous. Cosmopolitan, at least in the Northern Hemisphere. In the Monkman Pass area, widespread in the Shunda Formation and in the Unnamed unit.

Genus *Palaeoberesella* Mamet and Roux, 1974

Palaeoberesella lahuseni (von Möller, 1879)

Plate 12, fig. 9

Nodosinella lahuseni von Möller, 1879, p. 75, Plate 5, figs. 6-7.

(not) *Nodosinella lahuseni*; Liebus, 1932, p. 162, Plate 9, fig. 27.

?*Nodosinella lahuseni*; Mikhailov, 1935, p. 34.

Nodosinella lahuseni; Rauzer-Chernoussova, 1948a, figs. 4-9.

Nodosinella lahuseni; Rauzer-Chernoussova, 1948b, figs. 1, 3.

cf. *Trinodella* sp. Pelhate, 1969, p. 69, Plate 6, fig. 77.

Dvinella sp. Perret, 1971, p. 1941, Plate 1, fig. 1.

Kamaena aff. *lahuseni*; Mamet and Rudloff, 1972, p. 87, Plate 5, figs. 13-14.

Anthracoporellopsis sp. Ivanova, 1973, Plate 10, fig. 2.

Palaeoberesella lahuseni; Mamet and Roux, 1974, p. 144-148, Plate 2, figs. 20-27, Plate 3, figs. 1-29, Plate 4, figs. 1-17.

Nodosinella? *scalaris* Malakhova, 1975, p. 85-86, Plate 9, figs. 5-11.

Palaeoberesella lahuseni; Mamet, 1976, Plate 6, fig. 2, Plate 56, fig. 3, Plate 59, fig. 3.

Palaeoberesella lahuseni; Jansa, Mamet and Roux, 1978, p. 1434, Plate 1, figs. 15, 18.

Palaeoberesella lahuseni; Radionova, 1979, Plate 1, figs. 8-10.

Palaeoberesella lahuseni; Mamet and Martinez, 1980, no description, Plate 2, fig. 1.

Diagnosis. Thallus cylindrical, long, sinuous to regular, rarely dichotomous. Cortex, heavily calcified: diameter, 120 to 230 µm, usually approximately 180 to 200 µm. Medulla irregularly divided by partitions. Cells elliptical, truncated, subspherical in the central part to rectangular near the cortex. Cortex thickness 30 to 35 µm. Pores straight, fine, perpendicular to the cortex. Conceptacles spherical.

Stratigraphic range and distribution. Cosmopolitan. One of the most important limestone builders; forms bafflestone (see Mamet and Roux, 1978). All illustrated forms are from the Lower Carboniferous. The lowest occurrence is probably Devonian. In the Monkman Pass area, observed mainly in the upper part of the Pekisko Formation and in the Shunda Formation.

Genus *Pekiskopora* Mamet, 1974

Pekiskopora sp.

Plate 12, fig. 11

Pekiskopora sp. Mamet, 1974a, p. 42-43, Plate 3, figs. 1-4.

Diagnosis. Test composed of a small number of verticillae. Height of each verticil, 400 to 550 µm. Width, 250 to 300 µm. Medulla, up to 200 to 250 µm. Pores as projections from an initial short vestibule, forming a crown at the top of the verticil.

Remarks. This unnamed taxon, a diminutive *Pekiskopora macqueeni*, is about half the size of the type of *Pekiskopora*.

Stratigraphic range and distribution. Present in the North American Cordillera, from the top of Zone 7 through Zone 8. Original material from the middle Tournaisian Pekisko Formation of the Belcourt Creek section.

Phylum RHODOPHYCOPHYTA

Family SOLENOPORACEAE Pia, 1927

Genus *Parachaetetes* Deninger, 1906, *emend.* Mamet and Roux, 1977

Paracheatetes garwoodi (Hinde in Garwood, 1912)

Plate 12, fig. 6

Solenopora garwoodi Hinde in Garwood, 1912, p. 459, Plate 47, fig. 1.

Solenopora garwoodi; Hinde, 1913, p. 290-292, Plate 10, figs. 1-7.

Solenopora garwoodi; Garwood, 1916, Plate 18, figs. 1-2.

Solenopora sp. Reynolds 1921, Plate 10, fig. 2.

Pseudochaetetes garwoodi; Pia, 1937, p. 797-798, Plate 8, figs. 3-4.

Parachaetetes garwoodi; Mamet and Rudloff, 1972, p. 92, Plate 10, fig. 5.

Parachaetetes garwoodi; Mamet and Roux, 1977, p. 236, Plate 6, figs. 12-15, Plate 7.

Diagnosis. Solenoporid characterized by scarce septiform processes. Horizontal partitions continuous, regular, but with very uneven spacing. Height of cells varies from 15 to 50 µm (rarely 70 µm). Width of cells, 20 to 50 µm.

Stratigraphic range and distribution. Tournaisian-Viséan. North America. Tethys. In the Monkman Pass area, as nodules in the Shunda Formation and rare in the Unnamed unit.

Algal spore cases ("calcispheres")

Genus *Calcisphaera* Williamson, 1881

Calcisphaera laevis Williamson, 1881

Plate 12, fig. 12

For synonymy, see Armstrong and Mamet (1977), and add;

Calcisphaera laevis; Mamet and Armstrong, 1972, fig. 5D.

Calcisphaera laevis; Browne and Pohl, 1973, p. 191, Plate 22, figs. 4?, 5-7.

Calcisphaera laevis; Mamet, 1973, p. 110, Plate 3, figs. 4, 9, 10.

Pachysphaerina pachysphaerica Brazhnikova and Vdovenko, 1973, Plate 1, fig. 24.

Pachysphaerina cf. *pachysphaeroides* Monostori, 1974, p. 218-219, Plate 1, figs. 1-3.

Calcisphaera laevis; Armstrong and Mamet, 1975, figs. 11E, F.

Calcisphaera laevis; Mamet, 1976, Plate 12, fig. 4, Plate 14, fig. 11, Plate 23, figs. 1-4, Plate 29, figs. 1, 2, Plate 39, fig. 3, Plate 41, fig. 1, Plate 47, fig. 2, Plate 55, fig. 4, Plate 57, figs. 3, 4, Plate 69, figs. 1, 2, Plate 70, fig. 4, Plate 84, fig. 2, Plate 91, figs. 1, 2.

Calcisphaera laevis; Bamber and Mamet, 1978, Plate 3, fig. 1, Plate 4, fig. 4.

Diagnosis. Microcrystalline, hollow, calcite spherule. Outside diameter ranges from 110 to 180 µm. Inner cavity spherical. Wall calcareous, one-layered, microcrystalline; 15 to 30 µm. Pores(?) scarcely noticeable; maximum diameter section approximately 40 µm.

Remarks. Since its conception, *Calcisphaera* has been a controversial taxon. See Armstrong and Mamet (1977) for the historial development of the concept and detailed taxonomy. Further chaos was introduced in 1977 by Vachard, who definitely maintained (p. 163) that "*Calcisphaera laevis* Williamson 1880 has a totally useless original description and illustration, and it certainly seems unfounded to define a neotype or topotypes for that species". Ignoring Andrews formal emendation (1955), he further suggested that the only well described form of *Calcisphaera* is *Calcisphaera cancellata*, and formally proposed that species as the type of *Calcisphaera*. The original description and illustration of Williamson (1881; not 1880) is by no means "totally useless". It can be verified as correct at Rhydymwyn, the original locality where calcispheres abound in "in a very fine grained limestone of light brown colour" (Williamson, 1881, p. 520).

Slides P 1000-1001, in the Hunterian Museum, Glasgow, contain well preserved calcispheres of Rhydymwyn (*C. laevis, C. sol, C. hexagonata, C. fimbriata* and *C. cancellata*). In fact, calcispheres are so abundant in the slides that no one can guess which particular specimen, among the hundreds of *Calcisphaera laevis* present, would represent Judd's or Williamson's original ideas. Finally, *C. cancellatus* is the type of *Palaeocancellus* Derville (1952), which is a valid genus, and Vachard's proposal is here formally rejected as a threat to the taxonomic stability of two valid genera.

Stratigraphic range and distribution. Ubiquitous. Cosmopolitan in the Devonian and the Carboniferous. In the Monkman Pass area, extremely abundant in the Shunda Formation, very abundant in the basal Turner Valley Formation and present in the Pekisko Formation and in the Unnamed unit. Probably *in situ* in the restricted lagoonal facies, transported into the open marine facies.

Incertae sedis

Genus *Eovolutina* Antropov, 1950

Eovolutina tujmasensis Lipina, 1955

Plate 12, fig. 13

Eovolutina elementa (part) Antropov, 1950, p. 29, Plate 3, figs. 7-8, (not 8, the holotype).

Eovolutina tujmasensis Lipina, 1955, p. 23, Plate 2, figs. 6-7?

Eovolutina elementa; Lipina, 1955, p. 26, Plate 2, fig. 5.

(not) *Eovolutina elementa*; Konoplina, 1959, p. 28, Plate 4, fig. 3.

Eovolutina elementa; Lebedeva in Kalfina, 1962, p. 101, Plate C, figs. 5-6.

Eovolutina elementa; Bogush and Yuferev, 1962, p. 92, Plate 1, fig. 29.

Eovolutina tujmasensis; Bogush and Yuferev, 1962, p. 93, Plate 1, fig. 30.

(not) *Eovolutina elementa*; Chuvashov, 1965, p. 32, Plate 4, fig. 8.

Eovolutina elementa; Bogush and Yuferev, 1966, p. 77, Plate 1, fig. 8.

Eovolutina elementa; Aizenberg and Brazhnikova, 1966, p. 9, Plate 1, figs. 15, 16.

(not) *Eovolutina elementa*; Pojarkov, 1969, Plate 4, fig. 12.

(not) *Eovolutina tujmasensis*; Bogush and Yuferev, 1970, p. 97, Plate 1, fig. 4.

Eovolutina elementa forma delicata OBJ, infrasubspecific, Brazhnikova and Vdovenko, 1971, p. 24, Plate 1, figs. 17, 18.

(not) *Eovolutina elementa* forma typica OBJ, infrasubspecific, Brazhnikova and Vdovenko, 1971, p. 24, Plate 1, fig. 12.

Eovolutina tujmasensis; Malakhova, 1976, p. 10-11, Plate 2, fig. 30.

Eovolutina tujmasensis; Mamet, 1976, no text, Plate 14, fig. 6.

Diagnosis. "Test" composed of two (or three) encased micritic spherules. Diameter variable, depending on the section; maximum diameter 180 µm. Spherules connected by a "pore" or "opening"(?). Wall micritic, dark, dense, undifferentiated, 3 to 10 µm.

Stratigraphic range and distribution. Reported from the Upper Devonian to the Lower Carboniferous. Scarce in the Monkman area. Scattered through the Shunda Formation and the Unnamed unit.

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APPENDIX

Detailed Biostratigraphic Data

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Detailed Biostratigraphic Data

HOOK CREEK SECTION

(Fig. 3, loc. 1)

GSC loc. C-39087, 21.7 m below top of Banff Fm.

Calcisphaera laevis

GSC loc. C-39087A

Calcisphaera sp.

GSC loc. C-39087B

No microfauna

GSC loc. C-39089, 11.3-17.4 m below top of the Banff Fm.

Bisphaera sp.
Calcisphaera laevis
Earlandia sp.
Earlandia of the group *E. elegans*
Latiendothyra sp.
Septaglomospiranella sp.
Septaglomospiranella aff. *S. primaeva*

Age: Zone 7, middle Tournaisian

GSC loc. C39090, 5.2-11.3 m below top of Banff Fm.

Bisphaera sp.
Calcisphaera sp.
Latiendothyra sp.
Palaeospiroplectammina tchernyshinenesis
Septaglomospiranella sp.

Age: Zone 7, middle Tournaisian

GSC loc. C-39092, 0-7 m above base of Pekisko Fm.

No microfauna

GSC loc. C-39092A

No microfauna

GSC loc. C-39093, 7-13.1 m above base of Pekisko Fm.

Calcisphaera sp.
Septaglomospiranella sp.

GSC loc. C-39093A

Calcisphaera sp.
Latiendothyra of the group *L. parakosvensis*
Septaglomospiranella sp.

GSC loc. C-39094, 13.1-22 m above base of Pekisko Fm.

No microfauna

GSC loc. C-39096, 49.4-55.5 m above base of Pekisko Fm.

Asphaltinella sp.
Latiendothyra sp.
Septabrunsiina sp.
Septaglomospiranella sp.
Tuberendothyra sp.

Age: Zone 8, early late Tournaisian,
"*Asphaltinella* facies"

GSC loc. C-39097, 55.5-61.6 m above base of Pekisko Fm.

Calcisphaera sp.

GSC loc. C-39100, 7-13.1 m above base of Shunda Fm.

Calcisphaera sp.
Palaeoberesella sp.

GSC loc. C-39102, 19.5-25.6 m above base of Shunda Fm.

Calcisphaera sp.
extremely abundant *Issinella* sp.
Proninella sp.

GSC loc. C-39102A

Calcisphaera sp.
Issinella sp.
Latiendothyra sp.
Septabrunsiina sp.
Septaglomospiranella sp.
Spinoendothyra spinosa crassitheca
cf. *Tuberendothyra* sp.

Age: Zone 8/9, late Tournaisian

GSC loc. C-39102B

Calcisphaera sp.
Latiendothyra sp.
Parathurammina sp.
Ortonella sp.
Septabrunsiina sp.
Septaglomospiranella sp.
Spinoendothyra sp.
Rectoseptaglomospiranella sp.

GSC loc. C-39104, 31.7-37.8 m above base of Shunda Fm.

Calcisphaera sp.
Latiendothyra sp.
Parathurammina sp.
Palaeoberesella sp.
Proninella

GSC loc. C-39107, 5.0-56.1 m above base of Shunda Fm.

Calcisphaera laevis
Parathurammina sp.
Parathurammina dagmarae
Parathurammina spinosa
Parathurammina suleimanovi
Palaeoberesella sp.
Proninella sp.
Vicinesphaera sp.

GSC loc. C-39107A

Calcisphaera laevis
Bithurammina sp.
Parathurammina dagmarae
Parathurammina spinosa
Parathurammina suleimanovi
Palaeoberesella sp.
Proninella sp.

GSC loc. C-39108, 56.1-64.6 m above base of the Shunda Fm.

Calcisphaera sp.
Parthurammina dagmarae
Parathurammina spinosa
Parathurammina suleimanovi
Proninella sp.
Spinoendothyra sp.

GSC loc. C-39109, 64.6-72.6 m above base of Shunda Fm.

Brunsiina sp.
Calcisphaera laevis
Eoforschia sp.
"*Globoendothyra*" (?) *paratrachida*
"*Globoendothyra*" ? *trachida*
Issinella sp.
Latiendothyra sp.
Septaglomospiranella sp.
Spinobrunsiina parakrainica
Spinoendothyra sp.
Spinoendothyra bellicosta
Spinoendothyra paratumula
Spinoendothyra spinosa spinosa
Tournayella discoidea

Age: Zone 9, late Tournaisian

GSC loc. C-39111, 78.7-87.8 m above base of Shunda Fm.

Calcisphaera laevis
Earlandia sp.
Eoforschia sp.
Issinella sp.
Parathurammina sp.
Pseudochaetetes sp.
Palaeoberesella sp.
Radiosphaerina sp.
Septabrunsiina sp.
Septaglomospiranella sp.
Spinoendothyra sp.
Tournayella sp.

Age: Zone 9, late Tournaisian

GSC loc. C-39111A

Calcisphaera laevis
Bevocastria sp.
Issinella sp.
Kamaena sp.
Ortonella sp.
Palaeoberesella sp.
Parathurammina dagmarae
Parathurammina spinosa
Proninella sp.
Palaeoberesella sp.
Septaglomospiranella sp.

GSC loc. C-39113, 90.9-97.0 m above base of Shunda Fm.

Calcisphaera sp.
Calcisphaera laevis
Evlania sp.
Issinella sp.
Kamaena sp.
Ortonella sp.
Palaeoberesella sp.
Parathurammina sp.
Proninella sp.
Radiosphaera sp.
Vicinesphaera sp.

Age: Zone 9, late Tournaisian

GSC loc. C-39114, 97.0-103.1 m above base of Shunda Fm.

algal ghosts

GSC loc. C-39115, 103.1-107.7 m above base of Shunda Fm.

Calcisphaera sp.
Kamaena sp.
Latiendothyra parakosvensis
Laxoendothyra sp.
Palaeoberesella sp.
Ortonella sp.
Septaglomospiranella sp.
Spinoendothyra sp.

Age: Zone 9, late Tournaisian

GSC loc. C-39116, 107.7-115.6 m above base of Shunda Fm.

Calcisphaera sp.
Kamaena sp.
Evlania sp.
Issinella sp.
Latiendothyra sp.
Parathurammina sp.
Palaeoberesella sp.
Proninella sp.
Radiosphaera sp.
Septaglomospiranella sp.
Spinoendothyra sp.

Age: Zone 9, late Tournaisian

GSC loc. C-39118, 126.9-133 m above base of Shunda Fm.

Calcisphaera sp.
Issinella sp.
Latiendothyra sp.
Parathurammina dagmarae
Parathurammina spinosa
Parathurammina suleimanovi
Septabrunsiina sp.
Septaglomospiranella sp.

GSC loc. C-39118A

Calcisphaera laevis
Issinella sp.
Parathurammina dagmarae
Parathurammina spinosa
Parathurammina suleimanovi
Proninella sp.
Radiosphaerina sp.
Vicinesphaera sp.

GSC loc. C-39119, 133.0-138.2 m above base of Shunda Fm.

Calcisphaera laevis
Issinella sp.
Kamaena sp.
Parathurammina dagmarae
Parathurammina spinosa
Parathurammina suleimanovi
Palaeoberesella sp.
Proninella sp.
Radiosphaerina sp.
Vicinesphaera sp.

GSC loc. C-39119A

Calcisphaera sp.
Issinella sp.
Kamaena sp.
Parathurammina sp.
Palaeoberesella sp.
Parathurammina sp.
Radiosphaera sp.
Vicinesphaera sp.

Age: Zone 9, late Tournaisian

GSC loc. C-39120, 138.2-144.3 m above base of Shunda Fm.

Calcisphaera sp.
Issinella sp.
Evlania? sp.
Kamaena sp.
Kamaena itkillikensis
Palaeoberesella sp.
Proninella sp.
Parathurammina sp.
Vicinesphaera sp.

Age: Zone 9, late Tournaisian

GSC loc. C-39122, 147.0-152.5 m above base of Shunda Fm.

Calcisphaera sp.
Issinella sp.
Kamaena sp.
Latiendothyra sp.
Palaeoberesella sp.
Parathurammina sp.
Proninella sp.
Septabrunsiina sp.
Septaglomospiranella sp.

GSC loc. C-39123, 152.5-154.6 m above base of Shunda Fm.

Calcisphaera laevis
cf. *Endospiroplectammina* sp.
Parathurammina sp.
Proninella sp.

GSC loc. C-39124, 154.6-162.6 m above base of Shunda Fm.

Calcisphaera sp.
Issinella sp.
Kamaena sp.
Latiendothyra sp.
Palaeoberesella sp.
Proninella sp.

GSC loc. C-39125, 162.6-164.1 m above base of Shunda Fm.

Calcisphaera sp.
Parathurammina sp.
Proninella sp.

GSC loc. C-39125A

Calcisphaera sp.
"*Globoendothyra*" ?*trachida*
Issinella sp.
Parathurammina sp.
Palaeoberesella sp.
Proninella sp.
Septaglomospiranella sp.
Radiosphaerina sp.
Vicinesphaera sp.

GSC loc. C-39126, 185.4-197.0 m above base of Shunda Fm.

Calcisphaera laevis
Evlania sp.
Eotuberitina sp.
Inflatoendothyra sp.
Issinella sp.
Latiendothyra sp.
Palaeoberesella sp.
Parathurammina sp.
Septaglomospiranella sp.
Spinoendothyra sp.
Radiosphaerina sp.
Vicinesphaera sp.

Age: Zone 9/10 Tournaisian-Viséan passage beds

GSC loc. C-39128, 2.7-6.4 m above base of Turner Valley Fm.

Calcisphaera sp.
Earlandia sp.
cf. *Eoendothyranopsis*? sp.
Globoendothyra sp.
Inflatoendothyra sp.

Age: Basal Zone 10, earliest Viséan

GSC loc. C-39131, 0-1.5 m above base of Mount Head(?) Fm.

No microfossils

GSC loc. C-39132, 1.5-12.6 m above base of Mount Head(?) Fm.

Calcisphaera laevis
Earlandia sp.
Dainella sp.
Eoendothyranopsis hinduensis
Eoendothyranopsis of the group *E. spiroides*
Eoforschia sp.
Eoparastaffella ovalis
Inflatoendothyra parainflata
Mitcheldeania sp.

Age: Zone 11(?), early Viséan

GSC loc. C-39134, 14.3-17.1 m above base of Mount Head(?) Fm.

Calcisphaera laevis
Earlandia vulgaris
Eblanaia sp.
Dainella cussyensis
Endothyra sp.
Eoendothyranopsis hinduensis
Eoendothyranopsis spiroides spiroides
Eofoschia moelleri
Eoparastaffella ovalis
Globoendothyra of the group *G. baileyi*
Inflatoendothyra parainflata
Mikhailovella sp.
Mitcheldeania sp.
Paracaligelloides sp.
Parathurammina sp.
Pohlia henbesti
cf. *Spinoendothyra* sp.
Spinoendothyra recta
Vicinesphaera sp.
Stacheoides sp.

Age: Zone 11, early Viséan

GSC loc. C-39137, 29.3-35.4 m above base of Mount Head(?) Fm.

Calcisphaera pachysphaerica
Dainella sp.
Earlandia sp.
Eoendothyranopsis spiroides
Eoforschia sp.
Issinella sp.
Palaeoberesella sp.

GSC loc. C-39138, 29.3-36.0 m above base of Mount Head(?) Fm.

Calcisphaera laevis
Calcisphaera pachysphaerica
Dainella sp.
Endothyra sp.
Eoendothyranopsis sp.
Eoforschia sp.
Latiendothyra? sp.
Palaeoberesella sp.
Paracalligelloides sp.
Parathurammina sp.

GSC loc. C-39138A

Calcisphaera laevis
Calcisphaera pachysphaerica
Dainella sp.
Endothyra sp.
Eoendothyranopsis sp.
Eoforschia sp.
Eoendothyranopsis hinduensis
Eoendothyranopsis spiroides
Issinella sp.
Palaeoberesella sp.

Age: Zone 11, early Viséan

EAST FELLERS CREEK SECTION

(Fig. 3, loc. 2)

GSC loc. C-39421, 135.7-149.1 m above base of Banff Fm.

Calcisphaera sp.
Earlandia sp.
Umbellina sp.

GSC loc. C-39425, 176.3-178.7 m above base of Banff Fm.

Calcisphaera sp.
Chernyshinella sp.
Earlandia of the group *E. clavatula*
Latiendothyra sp.
Septabrunsiina sp.
Septaglomospiranella sp.

Age: Zone 7, middle Tournaisian

GSC loc. C-39431, 22.3-31.4 m above base of Pekisko Fm.

Asphaltinella sp.
Kamaena sp.
Palaeoberesella sp.

Age: Zone 8(?), late Tournaisian, "*Asphaltinella* facies"

GSC loc. C-39431A

Asphaltinella sp.

GSC loc. C-39432, 0-5.2 m above base of Shunda Fm.

Calcisphaera sp.
Parathurammina sp.

GSC loc. C-39432A

Calcisphaera sp.

GSC loc. C-39435, 21.0-27.1 m above base of Shunda Fm.

Calcisphaera sp.
Kamaena sp.
Latiendothyra sp.
Palaeoberesella sp.
Parathurammina sp.
Proninella sp.

GSC loc. C-39436, 27.1-34.2 m above base of Shunda Fm.

Calcisphaera sp.
Issinella sp.
Kamaena sp.
Latiendothyra sp.
Ortonella coloradoensis
Palaeoberesella sp.
Parathurammina sp.
Parachaetestes sp.
Pseudohedstroemia sp.
Proninella sp.
Spinoendothyra sp. (primitive)
cf. *Tuberendothyra* sp.

Age: Zone 8/9, late Tournaisian

GSC loc. C-39437, 34.2-40.3 m above base of Shunda Fm.

Calcisphaera sp.
Issinella sp.
Orthriosiphon sp.
Palaeoberesella sp.
Parathurammina sp.
Proninella sp.
Vicinesphaera sp.

GSC loc. C-39439, 46.4-52.5 m above base of Shunda Fm.

Calcisphaera sp.
Issinella sp.
Latiendothyra sp.
Spinobrunsiina anteflexa
Spinoendothyra costifera
Spinoednothyra paracostifera
Spinoendothyra spinosa

Age: Zone 9, latest Tournaisian

GSC loc. C-39443, 72.6-77.5 m above base of Shunda Fm.

Brunsiina sp.
Calcisphaera laevis
Earlandia clavatula
Issinella sp.
Glomospiranella sp.
Glomospiranella subglobosa
Kamaena sp.
Latiendothyra sp.
Orthriosiphon saskatchewanensis
Palaeoberesella sp.
Paradainella dainelliformis
Parathurammina sp.
Septabrunsiina sp.
Septaglomospiranella sp.
Spinoendothyra costifera
Spinoendothyra paratumula
Spinoendothyra spinosa spinosa
Spinoendothyra spinosa crassitheca
Vicinesphaera sp.

Age: Zone 9, latest Tournaisian

GSC loc. C-39445, 86.6-94.6 m above base of Shunda Fm.

Calcisphaera sp.
Earlandia sp.
Issinella sp.
Latiendothyra sp.
Ortonella sp.
Orthriosiphon sp.
Orthriosiphon saskatchewanensis
Parachaetetes garwoodi
Pseudohedstroemia sp.
Spinoendothyra sp.
Spinoendothyra spinosa
Vicinesphaera sp.

Age: Zone 9, latest Tournaisian

GSC loc. C-39446, 94.6-96.4 m above base of Shunda Fm.

Calcisphaera sp.
Earlandia sp.
Kamaena sp.
Eoforschia sp.
Septatournayella (?) *kennedyi*
Spinobrunsiina mackeei
Spinoendothyra sp.
Spinoendothyra paracostifera
Tournayella discoidea

Age: Zone 9, late Tournaisian

GSC loc. C-39447, 97.3-104.3 m above base of Shunda Fm.

Calcisphaera sp.
Earlandia sp.
Ortonella sp.
Spinoendothyra sp.

GSC loc. C-39448, 104.9-111.0 m above base of Shunda Fm.

Albertaporella sp.
Brunsia sp.
Calcisphaera laevis
Earlandia clavatula
Glomospiranella sp.
Inflatoendothyra sp.
Ortonella sp.
Orthriosiphon saskatchewanensis
Septabrunsiina sp.
Septatournayella sp.
Spinobrunsiina parakrainica
Spinoendothyra costifera
Spinoendothyra recta
Spinoendothyra spinosa spinosa
Tournayella sp.

Age: Zone 9, late Tournaisian

GSC loc. C-39450, 117.1-124.1 m above base of Shunda Fm.

Calcisphaera sp.
Earlandia sp.
Latiendothyra sp.
Laxoendothyra sp.
Orthriosiphon sp.
Spinoendothyra sp.
Spinoendothyra paratumula

Age: Zone 9, late Tournaisian

GSC loc. C-39452, 0.3-2.7 m above base of Turner Valley Fm.

Albertaporella sp.
Calcisphaera laevis
Conilites tchussovensis
Earlandia sp.
Earlandinella sp.
Eblanaia michoti michoti
Eoforschia sp.
Eoforschia moelleri
Endothyra sp.
cf. *Eoendothyranopsis* sp.
Pohlia henbesti
Skippella fellersi
Spinobrunsiina parakrainica
Spinoendothyra costifera
Spinoendothyra paratumula
Spinoendothyra spinosa crassitheca

Age: Zone 10, earliest Viséan

GSC loc. C-39454, 11.6-19.5 m above base of Turner Valley Fm.

Albertaporella sp.
Brunsia sp.
Calcisphaera pachysphaerica
Earlandia sp.
Endothyra sp.
Eoforschia sp.
Globoendothyra? sp.
Glomospiranella subglobosa
"*Globoendothyra*" ? *trachida*
Latiendothyra sp.
Spinoendothyra sp.

Age: Zone 10, early Viséan

GSC loc. C-39461, 17.7-20.4 m above base of Mount Head(?) Fm.

Earlandia clavatula
Earlandia vulgaris
Endothyra sp.
Eoendothyranopsis sp. (primitive)
Eoforschia sp.
Spinoendothyra sp.

Age: Same as C-39452

GSC loc. C-39462, 20.4-26.5 m above base of Mount Head(?) Fm.

Calcisphaera pachysphaerica
Earlandia clavatula
Endothyra sp.
primitive *Eoendothyranopsis*? sp.
Eoparastaffella sp.
Latiendothyra sp.
Spinoendothyra sp.

Age: Zone 10, early Viséan

GSC loc. C-39464, 32.6-38.7 m above base of Mount Head(?) Fm.

Albertaporella sp.
Brunsiina sp.
Calcisphaera pachysphaerica
Endothyra sp.
Eoendothyranopsis spiroides
Dainella cussyensis
Eoforschia moelleri
Inflatoendothyra parainflata
Latiendothyra sp.
Mediendothyra sp.
Orthriosiphon sp.
Priscella sp.
Skippella? sp.
Septabrunsiina sp.
Spinobrunsiina mackeei

Age: Zone 10, early Viséan

GSC loc. C-39465, 38.7-44.8 m above base of Mount Head(?) Fm.

Calcisphaera laevis
Calcisphaera pachysphaerica
Earlandia sp.
Inflatoendothyra sp.
Priscella sp.
Parathurammina sp.
Pseudoammodiscus sp.
Radiosphaerina sp.
Vicinesphaera sp.

GSC loc. C-39468, 59.8-76.3 m above base of Mount Head(?) Fm.

Calcisphaera pachysphaerica
Dainella cussyensis
Dainella dainae
Endothyra sp.
Eoendothyranopsis hinduensis
Eoendothyranopsis spiroides
Eoparastaffella ovalis
Globoendothyra of the group *G. baileyi*
Paradainella dainelliformis
Priscella sp.
Septabrunsiina sp.
Skippella fellersi
Spinoendothyra sp.

Age: Zone 11, early Viséan

GSC loc. C-39469, 76.3-87.2 m above base of Mount Head(?) Fm.

Calcisphaera pachysphaerica
Dainella cussyensis
Earlandia vulgaris
Endothyra sp.
Eoforschia sp.
Eoendothyranopsis hinduensis
Eoendothyranopsis spiroides
Eoparastaffella ovalis
Globoendothyra sp.
Planoendothyra sp.
Pohlia henbesti
Skippella sp.

Age: Zone 11, early Viséan

GSC loc. C-39469A

Calciphaera laevis
Calcisphaera pachysphaerica
Earlandia vulgaris
Endothyra sp.
Eoendothyranopsis sp.
Globoendothyra sp.
Issinella sp.
Parathurammina sp.
Skippella sp.

GSC loc. C-39471, 93.3-104.9 m above base of Mount Head(?) Fm.

Calcisphaera sp.
Endothyra sp.
Globoendothyra sp.
Eoendothyranopsis sp.

GSC loc. C-39472, 105.8-111.9 m above base of Mount Head(?) Fm.

Calcisphaera pachysphaerica
Earlandia sp.
Endothyra sp.
Eoendothyranopsis spiroides
Globoendothyra sp.
Issinella sp.
Parthurammina sp.
Priscella sp.

MOUNT BECKER

(Fig. 3, loc. 3)

GSC loc. C-39157, 6.7-14.0 m above base of Pekisko Fm.

Calcisphaera sp.

GSC loc. C-39157A

Calcisphaera sp.
Kamaena sp.

GSC loc. C-39157B

Kamaena itkillikensis

GSC loc. C-39158, 14.0-20.1 m above base of Pekisko Fm.

Calcisphaera sp.
Issinella sp.

GSC loc. C-39158A

Calcisphere ghosts

GSC loc. C-39158B

Calcisphaera laevis
Septabrunsiina? sp.
Septaglomospiranella? sp.

GSC loc. C-39160, 24.4-30.5 m above base of Pekisko Fm.

Calcisphaera sp.
Palaeoberesella lahuseni

GSC loc. C-39160A

Calcisphere ghosts

GSC loc. C-39160B

Calcisphaera sp.
Issinella sp.
Kamaena sp.
Palaeoberesella lahuseni

Age: Zone 8, late Tournaisian

GSC loc. C-39162, 36.6-43.6 m above base of Pekisko Fm.

Asphaltinella sp.
Calcisphaera sp.
Issinella sp.
Issinella devonica
Kamaena sp.
Palaeoberesella sp.

Age: Zone 8(?), late Tournaisian, "*Asphaltinella* facies"

GSC loc. C-39162A

Calcisphaera sp.
Issinella sp.
Kamaena sp.

GSC loc. C-39164, 8.8-9.8 m above base of Shunda Fm.

Calcisphaera sp.
Issinella sp.
Kamaena sp.
Kamaena itkillikensis
Kamaenella? sp.
Parathurammina sp.
Spinoendothyra sp.
Vicinesphaera sp.

Age: Zone 8, late Tournaisian

GSC loc. C-39167, 22.9-28.1 m above base of Shunda Fm.

Brunsiina sp.
Calcisphaera laevis
Earlandia sp.
Eovolutina tujmasensis
Latiendothyra sp.
Parathurammina sp.
Paradainella? sp.
Septabrunsiina sp.
Septaglomospiranella rossi
Rectoseptaglomospiranella sp. (relict)
Solenoporid algae
Spinobrunsiina parakrainica
Quasipolyderma sp.
Spinoendothyra sp.
Spinodoenthyra spinosa spinosa
Spinodoenthyra spinosa crassitheca
Tournayella sp.
spinose Tournayellidae
Tuberendothyra tuberculata

Age: Zone 8 (high) or 8/9 boundary, late Tournaisian

GSC loc. C-39169, 34.5-36.6 m above base of Shunda Fm.

Brunsia sp.
Brunsiina sp.
Calcisphaeria laevis
Earlandia sp.
Eovolutina sp.
Latiendothyra sp.
Issinella sp.
Kamaena sp.
Parathurammina sp.
Septabrunsiina sp.
Spinoendothyra sp.
Spinoendothyra spinosa
Tournayella sp.
Tournayella discoides

Age: Zone 9, late Tournaisian

GSC loc. C-39172, 48.2-56.7 m above base of Shunda Fm.

Calcisphaera sp.
Earlandia sp.
Issinella sp.
Palaeoberesella sp.
Proninella sp.
Spinoendothyra sp.

GSC loc. C-39179, 27.8-33.9 m above base of Unnamed unit.

foraminiferal ghosts

GSC loc. C-39179A

Endothyrid ghosts

GSC loc. C-39179B

Endothyrid ghosts
Tournayellid ghosts

GSC loc. C-39180, 33.9-42.1 m above base of Unnamed unit.

Spinoendothyra sp.

GSC loc. C-39182, 55.8-61.9 m above base of Unnamed unit.

Calcisphaera laevis
Paradainella sp.
Earlandia minima
Earlandia clavatula
Endothyra sp.
Eoforschia moelleri
Inflatoendothyra sp.
Issinella sp.
Lituotubellidae
Paracalligelloides sp.
Parathurammina sp.
Priscella prisca
Pseudoammodiscus sp.
Pohlia henbesti
Spinoendothyra paratumula
Spinoendothyra spinosa spinosa
Spinoendothyra spinosa crassitheca
Tournayella discoidea
Vicinesphaera sp.

Age: Zone 9/10, Tournaisian-Viséan passage, still latest Tournaisian

GSC loc. C-39183, 61.9-70.2 m above base of Unnamed unit.

Calcisphaera laevis
Dainella sp.
Earlandia clavatula sp.
Eoforschia moelleri
Eogloboendothyra sp.
Inflatoendothyra sp.
Issinella sp.
Latiendothyra sp.
Lituotubellidae
Parathurammina sp.
Priscella sp.
Paradainella sp.
Paracalligelloides sp.
Pohlia henbesti
Spinobrunsiina parakrainica
Spinoendothyra costifera
Spinoendothyra paracostifera
Spinoendothyra recta
Spinoendothyra spinosa crassitheca
Tournayella sp.
Vicinesphaera sp.

Age: Zone 9/10 boundary, Tournaisian-Viséan passage, earliest Viséan

GSC loc. C-39186, 0-5.8 m above base of Turner Valley Fm.

Eogloboendothyra sp.

GSC loc. C-39186A

No microfossils

GSC loc. C-39186B

No microfossils

GSC loc. C-39188, 12.2-18.3 m above base of Turner Valley Fm.

Calcisphaera laevis
Earlandia clavatula
Eoforschia sp.
Latiendothyra sp.
Priscella sp.
Pohlia henbesti

GSC loc. C-39188A

Calcisphaea laevis
Earlandia sp.
Eogloboendothyra sp.
Eoforschia sp.
Priscella sp.
Palaeoberesella sp.
Pohlia henbesti sp.
relict Spinoendothyrids
Tournayella discoidea?

Age: Zone 10, early Viséan

GSC loc. C-39188B

Calcisphaera laevis
Kamaena sp.
Palaeoberesella sp.

GSC loc. C-39189, 18.3-26.5 m above base of Turner Valley Fm.

Calcisphaera laevis
Calcisphaera pachysphaerica
Earlandia vulgaris
Endothyra sp.
Eoendothyranopsis of the group *E. spiroides*
Eoparastaffella? cf. *E. ovalis*
Eogloboendothyra sp.
Globoendothyra of the group *G. baileyi*
Kamaena sp.
Latiendothyra sp.
Laxoendothyra sp.
Palaeoberesella sp.
Parathurammina sp.
Priscella sp.

Age: Zone 11, early Viséan

GSC loc. C-39189A

Calcisphaera sp.
Earlandia sp.
Endothyra sp.
Eoforschia sp.
Eoendothyranopsis sp.
Eogloboendothyra sp.
Globoendothyra sp.
Latiendothyra sp.
Parathurammina sp.
Priscella sp.

GSC loc. C-39190, 26.5-35.7 m below top of Turner Valley Fm.

Endothyra sp.
Globoendothyra sp.

GSC loc. C-39192, 15.6-22.9 m above base of Mount Head(?) Fm.

Globoendothyra sp.
Priscella sp.

GSC loc. C-39194, 31.1-39.0 m above base of Mount Head(?) Fm.

Calcisphaera sp.
Earlandia clavatula
Dainella sp.
Eblanaia sp.
Endothyra sp.
Eoendothyranopsis spiroides
Eoforschia sp.
Globoendothrya of the group *G. baileyi*
Issinella sp.
Priscella sp.
Skippella redwallensis

Age: Zone 11, early Viséan

GSC loc. C-39194B

Calcisphaera pachysphaerica
Endothyra sp.
Eoendothyranopsis hinduensis
Eoforschia sp.
Eotuberitina sp.
Issinella sp.
Parathurammina sp.
Skippella redwallensis

GSC loc. C-39197, 47.0-53.1 m above base of Mount Head(?) Fm.

Calcisphaera laevis
Earlandia clavatula
Earlandia vulgaris
Endothyra sp.
Eoendothyranopsis spiroides
Eoendothyranopsis hinduensis
Eoforschia sp.
Globoendothyra? sp.
Issinella sp.
Palaeoberesella sp.
Paleoberesella lahuseni
Skippella redwallensis

Age: Zone 11, early Viséan

GSC loc. C-39198, 53.1-61.3 m above base of Mount Head(?) Fm.

Brunsia sp.
Calcisphaera pachysphaerica
Earlandia vulgaris
Endothyra sp.
Eoendothyranopsis hinduensis
Eoendothyranopsis spiroides
Eoforschia moelleri
Eoparastaffella ovalis
Eoparastaffella simplex
Globoendothyra of the group *G. baileyi*
Globoendothyra paula
Issinella devonica
Palaeoberesella sp.
Parathurammina sp.
Skippella fellersi
Skippella redwallensis

Age: Zone 12, middle Viséan

GSC loc. C-39199, 61.3-70.8 m above base of Mount Head(?) Fm.

Calcisphaera pachysphaerica
Earlandia clavatula
Earlandia vulgaris
Eoendothyranopsis hinduensis
Eoendothyranopsis spiroides
Endothyra sp.
Eoforschia sp.
Eoparastaffella sp.
Globoendothyra of the group *G. tomiliensis*
Issinella sp.
Koninckopora sp.
Mikhailovella sp.
Palaeoberesella sp.
Parathurammina sp.
Skippella sp.

Age: Zone 12, middle Viséan

GSC loc. C-39199A

Calcisphaera sp.
Earlandia sp.
Dainella sp.
Dainella cussyensis
Eoendothyranopsis spiroides
Globoendothyra of the group *G. tomiliensis*
Parathurammina sp.
Priscella sp.
Skippella sp.

GSC loc. C-39201, 77.8-79.3 m above base of Mount Head(?) Fm.

Calcisphaera sp.
Earlandia sp.
Dainella sp.
Eoendothyranopsis of the group *E. spiroides*
Eoforschia sp.
Planoendothyra sp.
Skippella sp.

GSC loc. C-39201A

Endothyrid ghost
Globoendothyrid ghost

GSC loc. C-39201B

Calcisphaerid ghost
Endothyrid ghost
Eoforschid ghost
Globoendothyrid ghost

GSC loc. C-39206, 117.1-123.2 m above base of Mount Head(?) Fm.

No microfossils observed

GSC loc. C-39207, 123.2-129.3 m above base of Mount Head(?) Fm.

No microfossils observed

GSC loc. C-39208, 129.3-131.8 m above base of Mount Head(?) Fm.

No microfossils observed

GSC loc. C-39208A

Calcisphaera sp.
Endothyra sp.
Radiosphaerina sp.

GSC loc. C-39208B

Calcisphaera sp.

GSC loc. C-39209, 129.6 m above base of Mount Head(?) Fm.

Calcisphaera sp.
Endothyra sp.
Globoendothyra sp.

GSC loc. C-39210, 131.8-139.1 m above base of Mount Head(?) Fm.

Endothyra sp.

MOUNT BECKER (A) SECTION

(Fig. 3, loc. 3)

GSC loc. C-39478, 105.0-105.2 m below top of Banff Fm.

Archaesphaera sp.
Earlandia minima

Age: Zone "pre-7", Middle Tournaisian, "*Earlandia minima* facies"

GSC loc. C-39485, 76.6-79.3 m below top of Banff Fm.

No microfossils observed

GSC loc. C-39485A

Wetheredella sp.

GSC loc. C-39486, 44.1-44.5 m below top of Banff Fm.

No microfossils observed

GSC loc. C-39486A

No microfossils observed

GSC loc. C-39491, 19.8-25.0 m below top of Banff Fm.

No microfossils observed

GSC loc. C-39491A

No microfossils observed

GSC loc. C-39493, 6.4-14.3 m below top of Banff Fm.

Asphaltinella sp.
Nostocites sp.

Age: Zone undetermined, "*Asphaltinella* facies"

GSC loc. C-39493A

Issinella sp.

GSC loc. C-39493B

Issinella sp.

GSC loc. C-39495, 0-4 m below top of Banff Fm.

Asphaltinella sp.

GSC loc. C-39495A

Asphaltinella sp.
Nostocites sp.

GSC loc. C-39495B

No microfossils observed

GSC loc. C-39496, basal Pekisko Fm.

No microfossils observed

BELCOURT CREEK SECTION

(Fig. 3, loc. 4)

GSC loc. C-39242, 80.2-82.4 m above base of Mount Head(?) Fm.

No microfossils observed

GSC loc. C-39242A

In reworked fragments:
  Eoendothyranopsis sp.
  Eoforschia sp.
  Globoendothyra sp.
  Pseudoammodiscus sp.

Reworked Viséan fragments

GSC loc. C-39249, 49.4-53.4 m above base of Mount Head(?) Fm.

Calcisphaera sp.
Earlandia sp.
Eoendothyranopsis hinduensis
Eoforschia sp.
Eoparastaffella ovalis
Eogloboendothyra sp.
Hydrozoan fragments
Parathurammina sp.

Age: Zone 11, early Viséan

GSC loc. C-39251, 34.2-43.6 m above base of Mount Head(?) Fm.

Brunsia sp.
Calcisphaera sp.
Earlandia sp.
Endothyra sp.
Dainella sp.
Eoendothyranopsis spiroides
Eoforschia sp.
Eoparastaffella sp.
Inflatoendothyra sp.
Latiendothyra sp.
Mikhailovella sp.
Parathurammina sp.
Priscella sp.
Septabrunsiina minuta
Spinoendothyra sp.
Spinoendothyra paracostifera

Age: Zone 11, early Viséan

GSC loc. C-39255, 0-4.6 m above base of Mount Head(?) Fm.

No microfossils observed

GSC loc. C-39262, 4.9-6.7 m above base of Turner Valley Fm.

Eoforschid ghost
Globoendothyrid ghost

Age: Undetermined Viséan Zone

GSC loc. C-39262A

Eoforschid ghost
Globoendothyrid ghost

Age: Undetermined Viséan Zone

GSC loc. C-39262B

Eoforschid ghost
Globoendothyrid ghost

Age: Undetermined Viséan Zone

GSC loc. C-39265, 78.4-84.8 m (top) above base of Unnamed unit.

No microfossils observed

GSC loc. C-39274, 10.1-15.6 m above base of Unnamed unit.

No microfossils observed

GSC loc. C-39276, 0-3.1 m above base of Unnamed unit.

Calcisphaera sp.
Palaeoberesella sp.
Proninella sp.

GSC loc. C-39276A

Calcisphaera sp.
Proninella sp.

GSC loc. C-39278, 98.2-104.3 m above base of Shunda Fm.

Calcisphaera sp.
Earlandia sp.
Inflatoendothyra sp.
Latiendothyra sp.
Laxoendothyra sp.
Ortonella sp.
Palaeoberesella sp.
Septabrunsiina sp.
Septaglomospiranella sp.
Spinoendothyra spinosa spinosa

Age: Zone 9, late Tournaisian

GSC loc. C-39278A

Calcisphaera laevis
Earlandia clavatula
Issinella sp.
Inflatoendothyra sp.
Latiendothyra sp.
Laxoendothyra sp.
Ortonella sp.
Palaeoberesella sp.
Parathurammina sp.
Septabrunsiina sp.
Septaglomospiranella sp.
Spinoendothyra spinosa spinosa
Tournayella sp.

Age: Zone 9, late Tournaisian

GSC loc. C-39278B

Palaeoberesella sp.
Spinoendothyra sp.

GSC loc. C-39280, 86.0-92.1 m above base of Shunda Fm.

Calcisphaera sp.
Earlandia sp.
Endothyra sp.
Parathurammina sp.
Septabrunsiina sp.
Septaglomospiranella sp.
Spinoendothyra sp.
Spinoendothyra spinosa
Spinoendothyra costifera
Tournayella sp.

Age: Zone 9, late Tournaisian

GSC loc. C-39281, 80.5-92.1 m above base of Shunda Fm.

Brunsia sp.
Issinella sp.
Palaeoberesella sp.
Ortonella coloradoensis
Ortonella tyrrelensis
Pseudohedstroemia polyfurcata
Septaglomospiranella sp.

Age: Zone 9, late Tournaisian

GSC loc. C-39283, 67.7-73.8 m above base of Shunda Fm.

Bevocastria? sp. (or *Mitcheldeania*? sp.)
Calcisphaera sp.
Earlandia sp.
Eoforschia sp.
"*Globoendothyra*" of "*G.? trachida*
Ortonella sp.
Pseudohedstroemia sp.
Spinoendothyra sp. (primitive form derived from *Tuberendothyra*)

Age: Zone 9, late Tournaisian

GSC loc. C-39289, 34.5-39.3 m above base of Shunda Fm.

Calcisphaera sp.
Earlandia sp.
Issinella sp.
Latiendothyra sp.
Parathurammina sp.
Palaeoberesella sp.
Proninella sp.
Radiosphaerina sp.

GSC loc. C-39290, 32.6-39.3 m above base of Shunda Fm.

Calcisphaera sp.
Earlandia sp.
Issinella sp.
Parathurammina sp.
Palaeoberesella sp.
Proninella sp. (extremely abundant)
Radiosphaerina sp.

GSC loc. C-39291, 27.1-32.6 m above base of Shunda Fm.

Calcisphaera sp.
Brunsiina sp.
Earlandia sp.
Issinella sp.
Latiendothyra sp.
Laxoendothyra sp.
Palaeoberesella sp.
Parathurammina sp.
Ortonella sp.
Septabrunsiina sp.
Septaglomospiranella sp.
Spinobrunsiina parakrainica
Spinoendothyra costifera
Spinoendothyra spinosa spinosa
Spinoendothyra spinosa crassitheca
Tournayella sp.
Tuberendothyra safonavae
Tuberendothyra tuberculata

Age: Zone 8/9, late Tournaisian

GSC loc. C-39294, 8.8-14.9 m above base of Shunda Fm.

Calcisphaera sp.
Issinella sp.
Parathurammina sp.
Palaeoberesella sp.
Proninella sp.

GSC loc. C-39295, 6.4 m above base of Shunda Fm.

No microfossils observed

GSC loc. C-39299, 47.3-53.4 m above base of Pekisko Fm.

Calcisphaera sp.
Issinella sp.
Palaeoberesella sp.
Septaglomospiranella sp.

GSC loc. C-39299A

Asphaltinella sp.
Calcisphaera sp.
Kamaena itkillikensis
Issinella sp.
Latiendothyra sp.
Palaeoberesella lahuseni
Palaeoberesella aff. *P. lahuseni*
Septaglomospiranella sp.
Tournayella sp.

Age: Zone 8, late Tournaisian, "*Asphaltinella* facies"

GSC loc. C-39302, 33.6-39.0 m above base of Pekisko Fm.

No microfossils observed

GSC loc. C-39302A

No microfossils observed

GSC loc. C-39306, 0-6.1 m above base of Pekisko Fm.

Asphaltinella sp.
Calcisphaera sp.
Septabrunsiina sp.
Septaglomospiranella primaeva
Septatournayella sp.
Rectoseptaglomospiranella nalivkini
primitive *Tuberendothyra* sp.

Age: upper Zone 7, middle Tournaisian

GSC loc. C-39308, 1.8-11.0 m below top of Banff Fm.

Calcisphaera sp.
Columbiapora sp.
Earlandia sp.
Latiendothyra sp.
Pekiskopora macqueeni
Septabrunsiina sp.
Septaglomospiranella primaeva
Septatournayella sp.
Rectoseptaglomospiranella sp.
primitive *Tuberendothyra* sp.

Age: upper Zone 7, middle Tournaisian

MOUNT HANINGTON NORTH

(Fig. 3, loc. 5)

GSC loc. C-79574, uppermost Banff Fm.

Asphaltinella sp.
Calcisphaera laevis
Parathurammina sp.
Pekiskopora sp.
Septaglomospiranella primaeva

Age: Upper part of Zone 7, middle Tournaisian

GSC loc. C-79575, 0.3 m above base of Pekisko Fm.

Columbiapora johnsoni
Pekiskopora sp.
Septaglomospiranella primaeva

Age: Upper part of Zone 7, middle Tournaisian

GSC loc. C-79576, 7.3 m above base of Pekisko Fm.

Asphaltinella sp.
Septaglomospiranella sp.

GSC loc. C-79577, 7.9 m above base of Pekisko Fm.

No identifiable microfauna

GSC loc. C-79578, 11.6 m above base of Pekisko Fm.

No identifiable microfauna

GSC loc. C-79579, 14.9 m above base of Pekisko Fm.

No identifiable microfauna

GSC loc. C-79580, 22.6 m above base of Pekisko Fm.

No identifiable microfauna

GSC loc. C-79581, 26.5 m above base of Pekisko Fm.

No identifiable microfauna

GSC loc. C-79582, 29.3 m above base of Pekisko Fm.

No identifiable microfauna

GSC loc. C-79583, 37.5 m above base of Pekisko Fm.

No identifiable microfauna

GSC loc. C-79584, 42.1 m above base of Pekisko Fm.

Issinella sp.
Septaglomospiranella sp.
Septatournayella sp.

GSC loc. C-79586, 43.3 m above base of Pekisko Fm.

Calcisphaera sp.
Issinella sp. (very abundant)

GSC loc. C-79587, 45.8 m above base of Pekisko Fm.

Issinella sp. (very abundant)
Palaeoberesella sp. (very abundant)
Septabrunsiia sp.

GSC loc. C-79588, 51.9 m above base of Pekisko Fm.

No identifiable microfauna

GSC loc. C-79589, 5.5 m above base of Pekisko Fm.

Asphaltinella sp.
Calcisphaera sp.
Earlandia sp.
Latiendothyra sp.
Ortonella coloradoensis
Proninella sp.
Pseudochaetetes sp.
Palaeoberesella sp.
Septabrunsiina sp.
Septaglomospiranella sp.
Spinobrunsiina sp.
Tuberendothyra sp.

Age: Zone 8, early late Tournaisian

GSC loc. C-79590, 61.9 m above base of Pekisko Fm.

Kamaena itkillikensis
Ortonella coloradoensis
Palaeoberesella lahuseni
Proninella sp.
Tuberendothyra tuberculata

Age: Zone 8, early late Tournaisian

GSC loc. C-79591, 1.2 m above base of Shunda Fm.

Issinella sp. (very abundant)
Palaeoberesella sp.
Tuberendothyra tuberculata

Age: Zone 8, early late Tournaisian

GSC loc. C-79592, 10.4 m above base of Shunda Fm.

Issinella sp. (very abundant)
Palaeoberesella sp. (very abundant)
Proninella sp.

GSC loc. C-79593, 0.25 m above base of Shunda Fm.

Issinella sp. (very abundant)

GSC loc. C-79594, 27.4 m above base of Shunda Fm.

Ortonella coloradoensis
Palaeoberesella lahuseni
Pseudokamaena sp.
Pseudohedstroemia polyfurcata
Tuberendothyra sp.

GSC loc. C-79595, 0.29 m above base of Shunda Fm.

Issinella sp.
Kamaena sp.
Proninella sp.
Parathurammina sp.
Palaeoberesella sp.

GSC loc. C-79596, 34.8 m above base of Shunda Fm.

Issinella sp.
Kamaena sp.
Parathurammina sp.
Palaeoberesella sp.
Proninella sp.

GSC loc. C-79597, 37.2 m above base of Shunda Fm.

Calcisphaera sp.
Issinella sp.
Kamaena sp.
Palaeoberesella sp.
Parathurammina sp.
Proninella sp.

GSC loc. C-79598, 44.8 m above base of Shunda Fm.

Calcisphaera sp.
Issinella sp.
Kamaena sp.
Palaeoberesella sp.
Parathurammina sp.
Proninella sp.
Septabrunsiina sp.
Septaglomospiranella sp.
Tuberendothyra tuberculata

Age: Zone 8, early late Tournaisian

GSC loc. C-79599, 49.4 m above base of Shunda Fm.

Calcisphaera sp.
Issinella sp. (very abundant)
Palaeoberesella sp.
Parathurammina sp.
Proninella sp.

GSC loc. C-79600, 53.4 m above base of Shunda Fm.

Calcisphaera sp.
Issinella sp.
Parathurammina sp.

GSC loc. C-79601, 61.6 m above base of Shunda Fm.

Calcisphaera sp.
Earlandia sp.
Palaeoberesella sp.
Parathurammina sp.
Proninella sp.
Spinoendothyra spinosa
Tuberendothyra tuberculata

Age: Zone 8/9 boundary, late Tournaisian

GSC loc. C-79602, 73.8 m above base of Shunda Fm.

Proninella sp. (very abundant)

GSC loc. C-79603, 81.1 m above base of Shunda Fm.

Calcisphaera sp.
Issinella sp.
Kamaena sp.
Palaeoberesella sp.
Parathurammina sp.
Radiosphaerid

GSC loc. C-79604, 84.8-94.2 m above base of Shunda Fm.

No identifiable microfauna

GSC loc. C-79605, 102.8 m above base of Shunda Fm.

Calcisphaera sp.
Earlandia sp.
Issinella sp.
Palaeoberesella sp.
Parathurammina sp.
Spinoendothyra spinosa crassitheca
Spinoendothyra spinosa spinosa

Age: Zone 9, latest Tournaisian

GSC loc. C-79606, 113.5 m above base of Shunda Fm.

Brunsiina sp.
Calcisphaera laevis
Earlandia clavatula
Inflatoendothyra sp.
Issinella sp.
Kamaena sp.
Latiendothyra sp.
Palaeoberesella lahuseni
Pseudokamaena sp.
Septabrunsiina sp.
Spinobrunsiina sp.
Spinoendothyra spinosa spinosa

Age: Zone 9, latest Tournaisian

GSC loc. C-79607, 118.0 m above base of Shunda Fm.

Calcisphaera sp.
Parathurammina sp.
Proninella sp.

GSC loc. C-79608, 126.9 m above base of Shunda Fm.

Calcisphaera laevis
Earlandia sp.
Issinella sp. (very abundant)
Kamaena sp.
Parathurammina sp.
Proninella sp.

GSC loc. C-79609, 140.9 m above base of Shunda Fm.

Calcisphaera sp.
Earlandia sp.
Ortonella sp.
Parathurammina sp.
Proninella sp.

GSC loc. C-79610, 154.0 m above base of Shunda Fm.

Calcisphaera sp.
Palaeoberesella sp.
Parathurammina sp.
Proninella sp.

GSC loc. C-79611, above base of Turner Valley Fm.

Calcisphaera sp.
Kamaena sp.
Palaeoberesella sp.
Parathurammina sp.
Proninella sp.

GSC loc. C-79612, 1.2 m above base of Turner Valley Fm.

Calcisphaera sp.
Issinella sp.
Proninella sp.

GSC loc. C-79614, 7.6 m above base of Turner Valley Fm.

Calcisphaera sp.
Parathurammina sp.

GSC loc. C-79615, 11.9 m above base of Turner Valley Fm.

Calcisphaera sp.
Earlandia sp.
Issinella sp.
Palaeoberesella sp.
Parathurammina sp.
Spinoendothyra sp.

GSC loc. C-79616, 15.3 m above base of Turner Valley Fm.

No identifiable microfauna

GSC loc. C-79617, 19.5 m above base of Turner Valley Fm.

Calcisphaera pachysphaerica
Earlandia sp.
Eoparastaffella sp.
Globoendothyra sp.
Globoendothyra bridgensis
Inflatoendothyra sp.

Age: Zone 10, earliest Viséan

GSC loc. C-79618, 7.6 m above base of Mount Head(?) Fm.

No identifiable microfauna

GSC loc. C-79619, 14.8 m above base of Mount Head(?) Fm.

Endothyrid ghosts

GSC loc. C-79620, 24.1 m above base of Mount Head(?) Fm.

Endothyrid ghosts

GSC loc. C-79621, 34.8 m above base of Mount Head(?) Fm.

Endothyrid ghosts

GSC loc. C-79622, 40.9 m above base of Mount Head(?) Fm.

Endothyrid ghosts

GSC loc. C-79623, 58.9 m above base of Mount Head(?) Fm.

No identifiable microfauna

GSC loc. C-79624, 61.9 m above base of Mount Head(?) Fm.

No identifiable microfauna

GSC loc. C-79625, 69.8 m above base of Mount Head(?) Fm.

Endothyrid ghosts

GSC loc. C-79626, 74.1 m above base of Mount Head(?) Fm.

Eoforschia of the group *E. moelleri*

GSC loc. C-79629, 97.0 m above base of Mount Head(?) Fm.

Endothyrid ghosts

GSC loc. C-79630, 121.4 m above base of Mount Head(?) Fm.

No identifiable microfauna

GSC loc. C-79631, 126.0 m above base of Mount Head(?) Fm.

No identifiable microfauna

GSC loc. C-79633, 141.2 m above base of Mount Head(?) Fm.

No identifiable microfauna

GSC loc. C-79634, 180.6 m above base of Mount Head(?) Fm.

No identifiable microfauna

GSC loc. C-79636, 198.3 m above base of Mount Head(?) Fm.

No identifiable microfauna

GSC loc. C-79637, 202.2 m above base of Mount Head(?) Fm.

No identifiable microfauna

PLATES 1-12

Illustrations of fossils

PLATES 13-18

Illustrations of rock types

PLATE 1

Figure	1.	*Earlandia minima* (Birina)	(page 7)
		GSC 65694; GSC loc. C-39182; Mamet No. 430/27; Unnamed unit, 55.8-61.9 m above base; Zone 9/10 boundary, Tournaisian-Viséan transition; x85.	
Figures	2, 3.	*Glomospiranella subglobosa* (Malakhova)	(page 7)
	2.	GSC 65695; GSC loc. C-39454; Mamet No. 427/3; East Fellers Creek Section, Turner Valley Formation, 11.6-19.5 m above base; Zone 10, early Viséan; x85.	
	3.	GSC 65696; GSC loc. C-39443; Mamet No. 426/9; East Fellers Creek Section, Shunda Formation, 72.6-77.5 m above base; Zone 9, latest Tournaisian; x85.	
Figures	4, 5.	*Tournayella discoidea* Dain in Dain and Grozdilova	(page 8)
	4.	GSC 65967; GSC loc. C-39446; Mamet No. 425/7; East Fellers Creek Section, Shunda Formation, 94.6-96.4 m above base; Zone 9, latest Tournaisian; x85.	
	5.	GSC 65698; GSC loc. C-39188; Mamet No. 419/9; Mount Becker Section, Turner Valley Formation, 12.2-18.3 m above base; Zone 10, earliest Viséan; x85.	
Figures	6-8.	*Septaglomospiranella rossi* Skipp in McKee and Gutschick	(page 8)
	6.	GSC 65699, GSC loc. C-39167; Mamet No. 418/15; Mount Becker Section, Shunda Formation, 22.9-28.1 m above base; Zone 8/9 boundary, late Tournaisian, x85.	
	7.	GSC 65700; GSC loc. C-39167; Mamet No. 430/23; as for figure 6; x85.	
	8.	GSC 65701; GSC loc. C-39167; Mamet No. 420/7; as for figure 6; x85.	
Figure	9.	*Septatournayella* (?) *kennedyi* Skipp, Holcomb and Gutschick	(page 9)
		GSC 65702; GSC loc. C-39446; Mamet No. 425/4, as for figure 4; x85.	
Figure	10.	*Spinobrunsiina anteflexa* (Zeller)	(page 10)
		GSC 65703; GSC loc. C-39439; Mamet No. 424/37; East Fellers Creek Section, Shunda Formation, 46.4-52.5 m above base; Zone 9, latest Tournaisian; x85.	
Figure	11.	*Septabrunsiina minuta* (Lipina) (*Endothyra taedia* of Zeller)	(page 9)
		GSC 65704; GSC loc. C-39251; Mamet No. 422/13; Belcourt Creek Section, Mount Head(?) Formation, 34.2-43.6 m above base; Zone 11, early Viséan, x85.	
Figures	12-17.	*Spinobrunsiina parakrainica* (Skipp, Holcomb and Gutschick)	(page 10)
	12.	GSC 65705; GSC loc. C-39167; Mamet No. 418/13; as for figure 6; x85.	
	13.	GSC 65706; GSC loc. C-39291; Mamet No. 422/24; Belcourt Creek Section, Shunda Formation, 27.1-32.6 m above base; Zone 8/9, late Tournaisian; x69.	
	14.	GSC 65707; GSC loc. C-39109; Mamet No. 423/9; Hook Creek Section, Shunda Formation, 64.6-72.6 m above base; Zone 9, late Tournaisian, x69.	
	15.	GSC 65708; GSC loc. C-39183; Mamet No. 420/24; Mount Becker Section, Unnamed unit, 61.9-70.2 m above base; Zone 9/10 boundary, Tournaisian-Viséan transition; x69.	
	16.	GSC 65709; GSC loc. C-39452; Mamet No. 426/32; East Fellers Creek Section, Turner Valley Formation, 0.3-2.7 m above base; basal Zone 10, earliest Viséan; x69.	
	17.	GSC 65710; GSC loc. C-39291; Mamet No. 422/9; as for figure 13; x69.	

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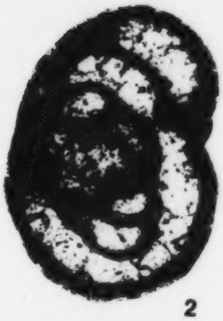
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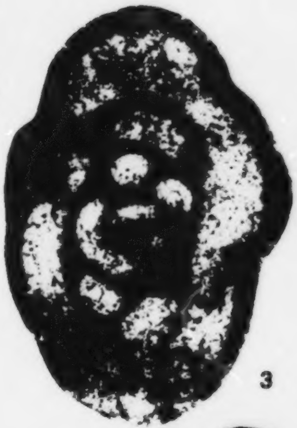
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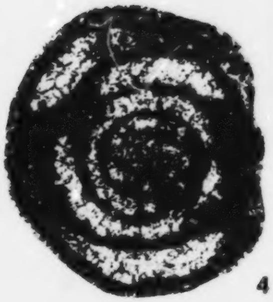
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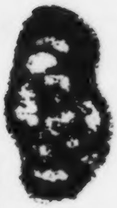
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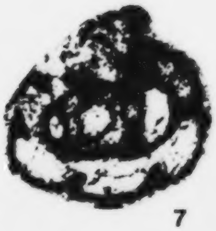
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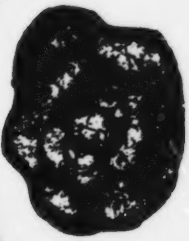
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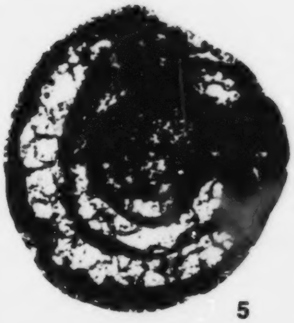
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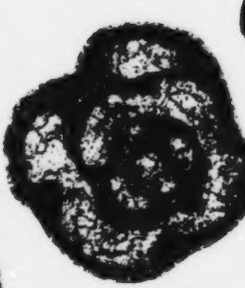
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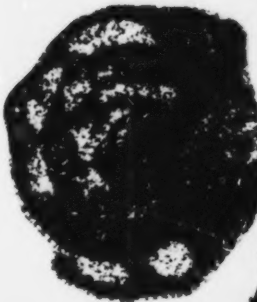
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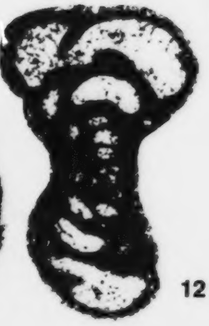
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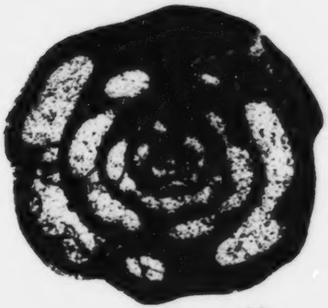
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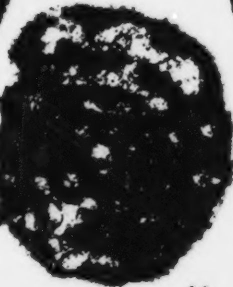
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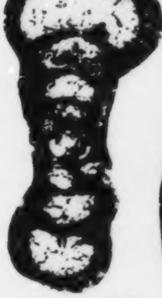
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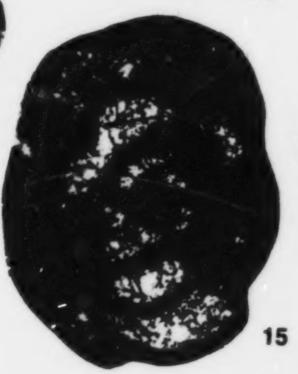
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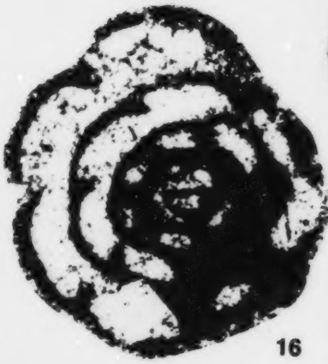
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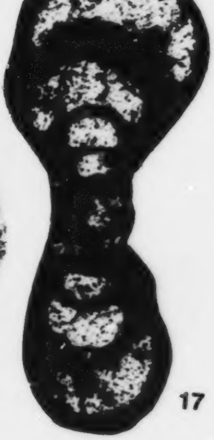
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PLATE 2

Figures 1, 2. *Spinobrunsiina mackeei* (Skipp, Holcomb and Gutschick) (page 11)

1. GSC 65711; GSC loc. C-39464; Mamet No. 427/5, East Fellers Creek Section, Mount Head(?) Formation, 32.6-38.7 m above base; Zone 10, early Viséan; x85.

2. GSC 65712; GSC loc. C-39446; Mamet No. 425/5; East Fellers Creek Section, Shunda Formation, 94.6-96.4 m above base; Zone 9, late Tournaisian; x85.

Figures 3, 4. *Spinotournayella tumula* (Zeller) (page 11)

3. GSC 65713; GSC loc. C-69520; Mamet No. 442/31; North Burnt River Section, 55°14'30"N, 122°05'W; Pine Pass map area, Pekisko Formation, 44.5-50.6 m below top; Zone 8, late Tournaisian; x69.

4. GSC 65714; GSC loc. C-69520; Mamet No. 429/3; as for figure 3; x69.

Figures 5-10. *Pohlia henbesti* (Skipp, Holcomb and Gutschick) (page 12)

5. GSC 65715; GSC loc. C-39469; Mamet No. 425/37; East Fellers Creek Section, Mount Head(?) Formation, 76.3-87.2 m above base; Zone 11(?), early Viséan; x54.

6. GSC 65716; GSC loc. C-39134; Mamet No. 423/33; Hook Creek Section, Mount Head(?) Formation, 14.3-17.1 m above base; Zone 11, early Viséan; x69.

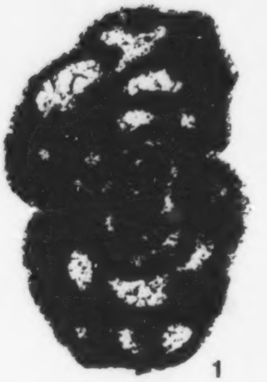
7. GSC 65717; GSC loc. C-39469; Mamet No. 425/33; as for figure 5; x69.

8. GSC 65718; GSC loc. C-39452; Mamet No. 426/27; East Fellers Creek Section, Turner Valley Formation, 0.3-2.7 m above base, basal Zone 10, earliest Viséan; x69.

9. GSC 65719; GSC loc. C-39188; Mamet No. 419/11; Mount Becker Section, Turner Valley Formation, 12.2-18.3 m above base, Zone 10, early Viséan; x54.

10. GSC 65720; GSC loc. C-39452; Mamet No. 426/20; as for figure 8, x69.

PLATE 2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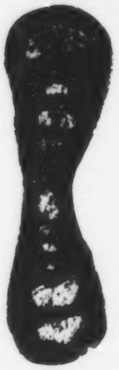
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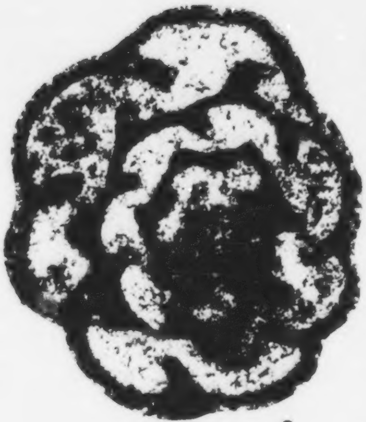
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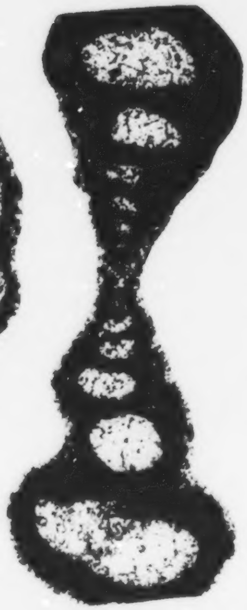
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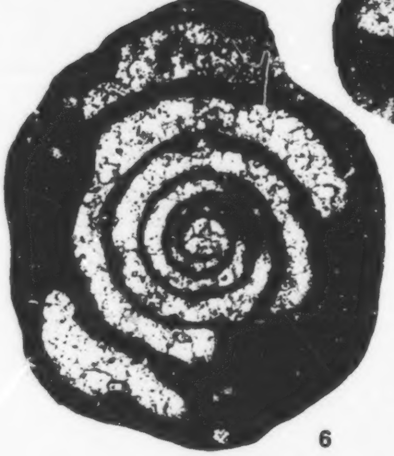
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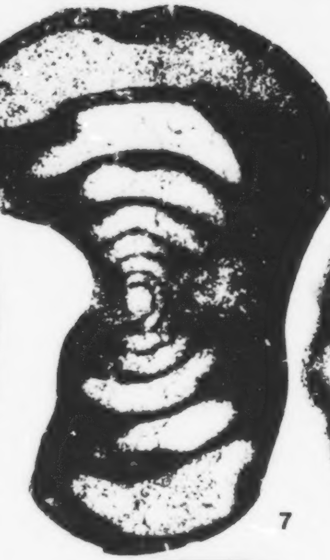
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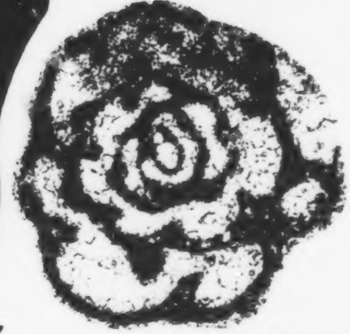
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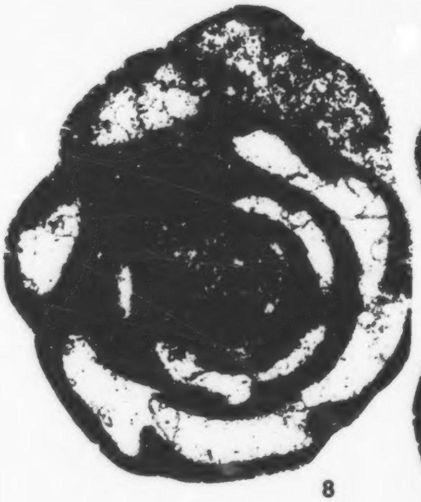
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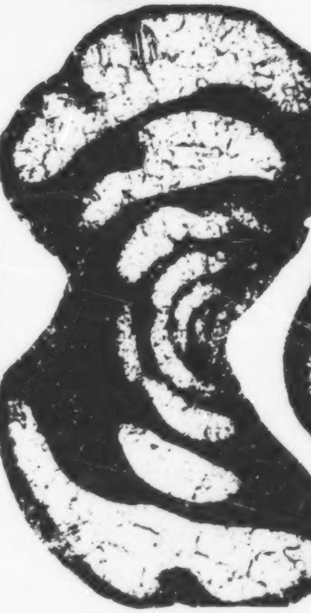
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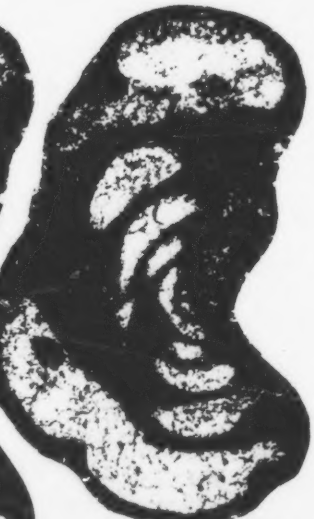
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PLATE 3

Figure 1. *Pohlia henbesti* (Skipp, Holcomb and Gutschick) (page 12)

GSC 65721; GSC loc. C-39182; Mamet No. 420/14; Mount Becker Section, Unnamed unit, 55.8-61.9 m above base, Zone 9/10 boundary, Tournaisian-Viséan transition; x54.

Figures 2, 3. *Eoforschia* of the group *E. moelleri* (Malakhova in Dain) (page 12)

2. GSC 65722; GSC loc. C-39182; Mamet No. 418/24; as for figure 1; x54.

3. GSC 65723; GSC loc. C-39198; Mamet No. 421/1; Mount Becker Section, Mount Head(?) Formation, 53.1-61.3 m above base, Zone 12, middle Viséan; x54.

Figure 4. *Latiendothyra parakosvensis* (Lipina) (page 13)

GSC 65724; GSC loc. C-39115; Mamet No. 424/12; Hook Creek Section, Shunda Formation, 103.1-107.1 m above base, Zone 9, late Tournaisian; x69.

Figure 5. *Latiendothyra rjausakensis* (Chervysheva) (page 13)

GSC 65725; GSC loc. C-69512; Mamet No. 442/17; Burnt River Section, 55°12'N, 122°02'30"W, Pine Pass map area, Turner Valley(?) Formation, 50.3-58.9 m above base, zones 10-11, early Viséan; x85.

Figure 6. *Priscella* of the group *P. prisca* (Rauzer-Chernoussova and Reitlinger) (page 14)

GSC 65726; GSC loc. C-39182; Mamet No. 418/19; as for figure 1; x85.

Figures 7-11. *Conilites tchussovensis* Postojalko in Malakhova et al. (page 13)

7. GSC 65727; GSC loc. C-39452; Mamet No. 425/21; East Fellers Creek Section, Turner Valley Formation, 0.3-2.7 m above base, basal Zone 10, earliest Viséan; x22.

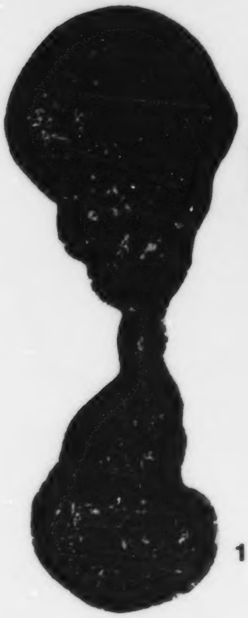
8. Enlargement of figure 7, x106.

9. GSC 65729; GSC loc. C-39452; Mamet No. 425/19; as for figure 7; x54.

10. GSC 65730; GSC loc. C-39452; Mamet No. 426/25; as for figure 7; x54.

11. GSC 65731; GSC loc. C-39452; Mamet No. 430/7; as for figure 7; x54.

PLATE 3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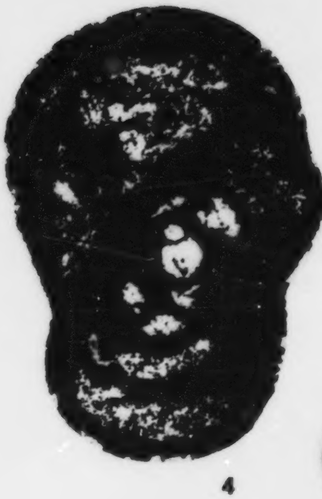
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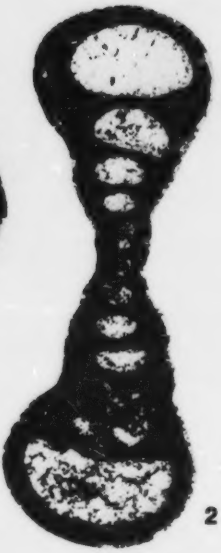
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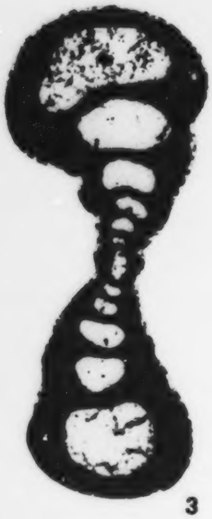
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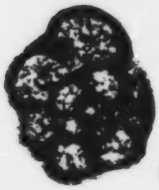
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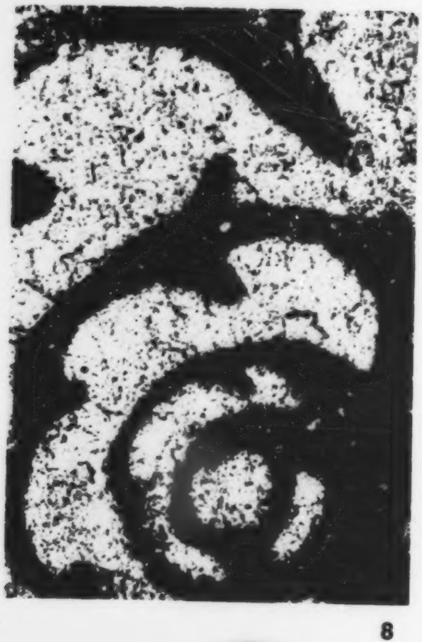
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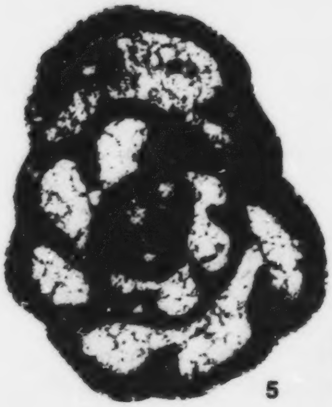
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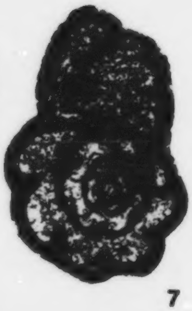
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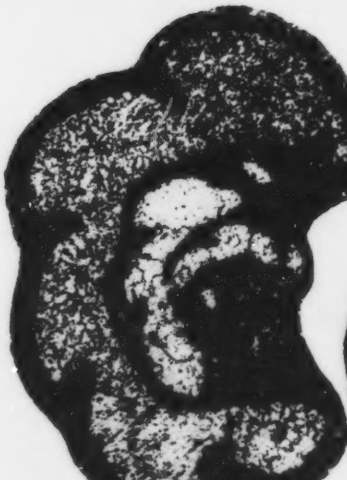
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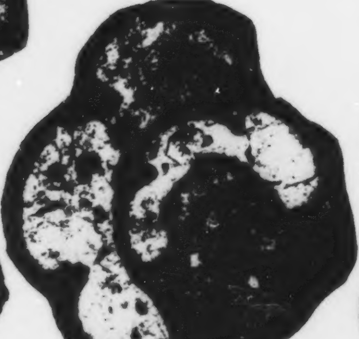
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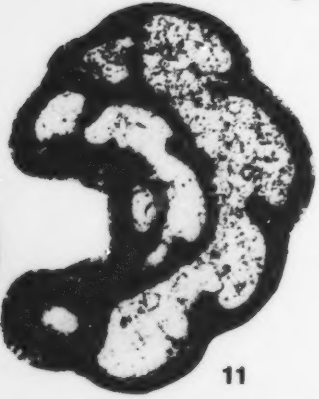
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PLATE 4

Figures 1-8. *Spinoendothyra spinosa spinosa* (Chernysheva) (page 15)

1. GSC 65732; GSC loc. C-39167; Mamet No. 420/1; Mount Becker Section, Shunda Formation, 22.9-28.1 m above base, Zone 8/9 boundary, late Tournaisian; x85.

2. GSC 65733; GSC loc. C-39109; Mamet No. 423/6; Hook Creek Section, Shunda Formation, 64.6-72.6 m above base, Zone 9, late Tournaisian; x85.

3. GSC 65734; GSC loc. C-39167; Mamet No. 419/23; as for figure 1; x85.

4. GSC 65735; GSC loc. C-39167; Mamet No. 418/11; as for figure 1; x85.

5. GSC 65736; GSC loc. C-39443; Mamet No. 425/1; East Fellers Creek Section, Shunda Formation, 72.6-77.5 m above base, Zone 9, late Tournaisian; x69.

6. GSC 65737; GSC loc. C-39278; Mamet No. 421/33; Belcourt Creek Section, Shunda Formation, 98.2-104.3 m above base, Zone 9, late Tournaisian; x85.

7. GSC 65738; GSC loc. C-39448; Mamet No. 426/13; East Fellers Creek Section; Shunda Formation, 104.9-111.0 m above base, Zone 9, late Tournaisian; x69.

8. GSC 65739; GSC loc. C-39182; Mamet No. 430/32; Mount Becker Section, Unnamed unit, 55.8-61.9 m above base, Zone 9/10 boundary, Tournaisian-Viséan transition; x85.

Figures 9-12. *Spinoendothyra spinosa crassitheca* subsp. nov. (page 16)

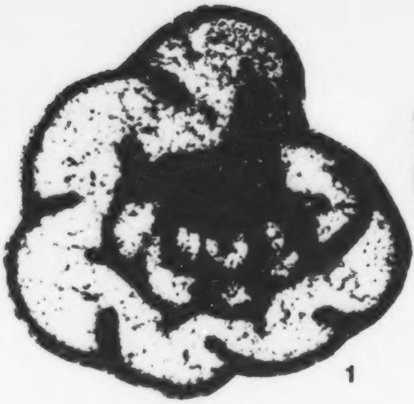
9. GSC 65740, paratype; GSC loc. C-39183; Mamet No. 420/25; Mount Becker Section, Unnamed unit, 61.9-70.2 m above base, Zone 9/10 boundary, Tournaisian-Viséan transition; x69.

10. GSC 65741, paratype; GSC loc. C-39182; Mamet No. 420/10; as for figure 8; x69.

11. GSC 65742, paratype; GSC loc. C-39452; Mamet No. 429/29; East Fellers Creek Section, Turner Valley Formation, 0.3-2.7 m above base, basal Zone 10, earliest Viséan; x54.

12. GSC 65743, paratype; GSC loc. C-39433; Mamet No. 425/2; as for figure 5; x59.

PLATE 4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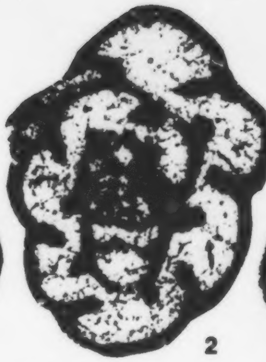
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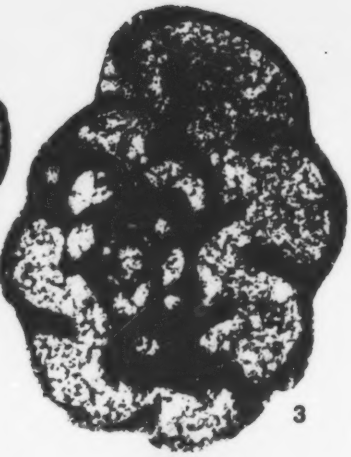
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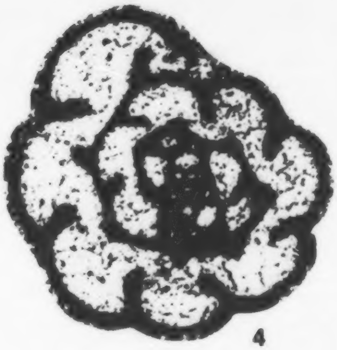
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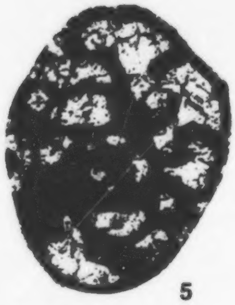
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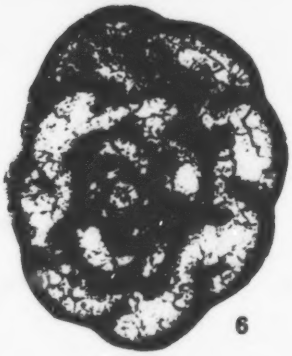
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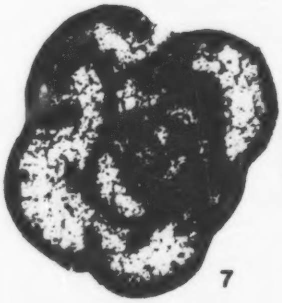
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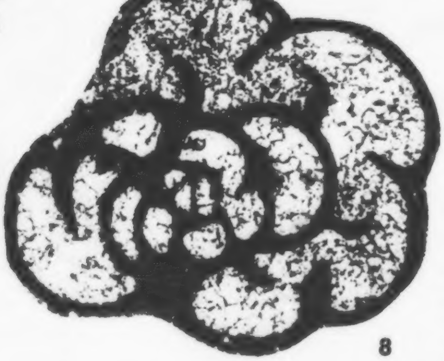
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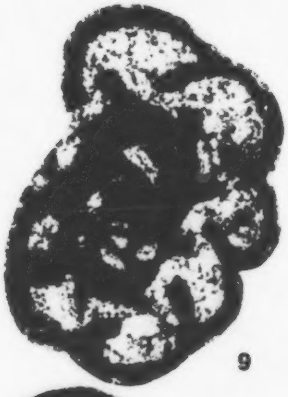
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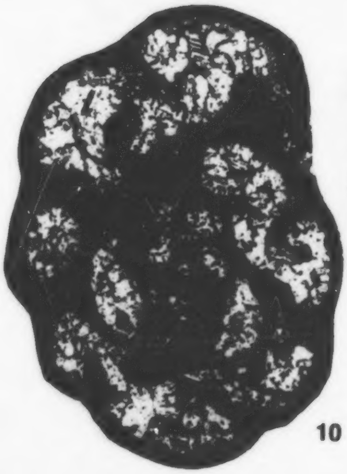
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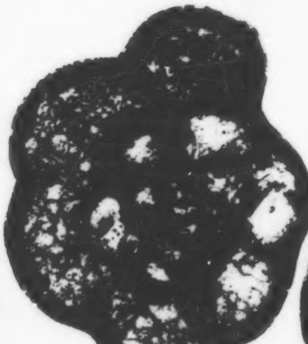
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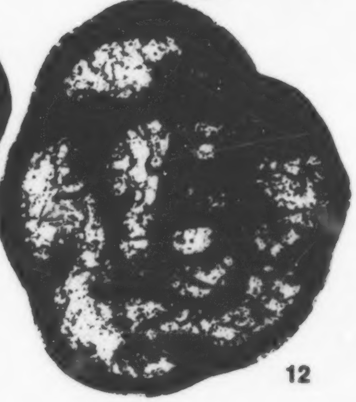
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PLATE 5

Figures 1-4. *Spinoendothyra spinosa crassitheca* subsp. nov. (page 16)

1. GSC 65744, holotype, GSC loc. C-39167; Mamet No. 420/5; Mount Becker Section, Shunda Formation, 22.9-28.1 m above base, Zone 8/9 boundary, late Tournaisian; x85.

2. GSC 65745, paratype; GSC loc. C-39452; Mamet No. 430-15; East Fellers Creek Section, Turner Valley Formation, 0.3-2.7 m above base, basal Zone 10, earliest Viséan; x85.

3. GSC 65746, paratype; GSC loc. C-39291; Mamet No. 422/7; Belcourt Creek Section, Shunda Formation, 27.1-32.6 m above base, Zone 8/9 boundary, late Tournaisian; x85.

4. GSC 65747, paratype; GSC loc. C-39452; Mamet No. 429/36; as for figure 2; x85.

Figures 5-8. *Spinoendothyra paracostifera* (Lipina in Grozdilova and Lebedeva) (page 17)

5. GSC 65748; GSC loc. C-39439; Mamet No. 424/36; East Fellers Creek Section, Shunda Formation, 46.4-52.5 m above base, Zone 9, late Tournaisian; x69.

6. GSC 65749; GSC loc. C-39446; Mamet No. 425/6; East Fellers Creek Section, Shunda Formation, 94.6-96.4 m above base, Zone 9, late Tournaisian; x85.

7. GSC 65750; GSC loc. C-39183; Mamet No. 420/22; Mount Becker Section, Unnamed unit, 61.9-70.2 m above base, Zone 9/10 boundary, Tournaisian-Viséan transition; x69.

8. GSC 65751; GSC loc. 39251; Mamet No. 422/18; Belcourt Creek Section, Mount Head(?) Formation, 34.2-43.6 m above base, Zone 11, early Viséan; x85.

Figures 9-14. *Spinoendothyra paratumula* (Skipp in McKee and Gutschick) (page 17)

9. GSC 65752; GSC loc. C-39452; Mamet No. 426/29; as for figure 2; x85.

10. GSC 65753; GSC loc. C-39450; Mamet No. 425/13; East Fellers Creek Section, Shunda Formation, 117.1-124.1 m above base, Zone 9, late Tournaisian; x85.

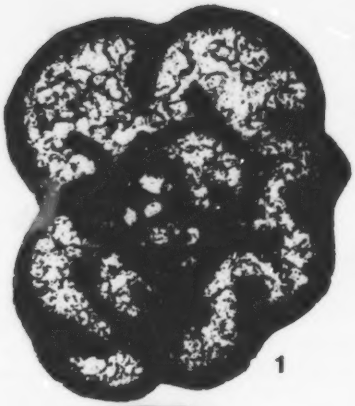
11. GSC 65754; GSC loc. C-39182; Mamet No. 430/33; Mount Becker Section, Unnamed unit, 55.8-61.9 m above base, Zone 9/10 boundary, Tournaisian-Viséan transition; x85.

12. GSC 65755; GSC loc. C-39109; Mamet No. 424/5; Hook Creek Section, Shunda Formation, 64.6-72.6 m above base, Zone 9, late Tournaisian; x85.

13. GSC 65756; GSC loc. C-39109; Mamet No. 424/2; as for figure 12; x85.

14. GSC 65757; GSC loc. C-39443; Mamet No. 426/10; East Fellers Creek Section, Shunda Formation, 72.6-77.5 m above base, Zone 9, late Tournaisian; x85.

PLATE 5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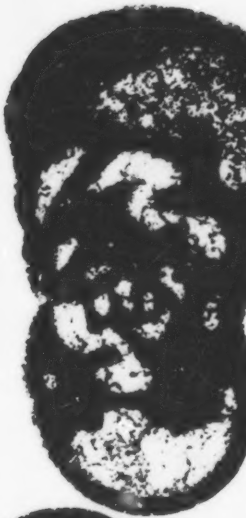
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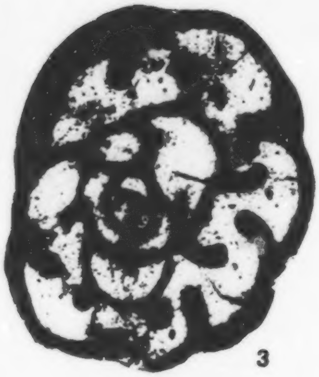
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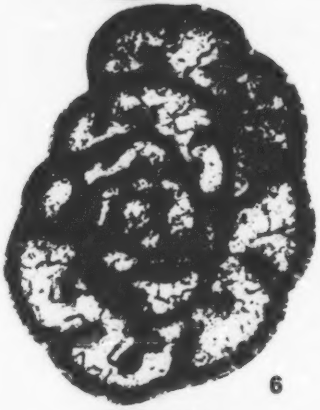
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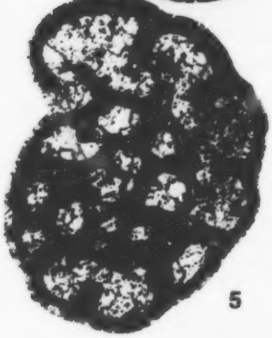
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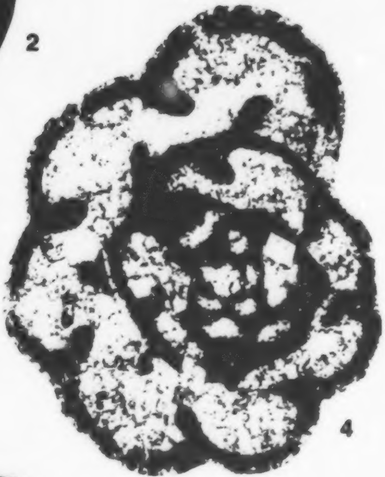
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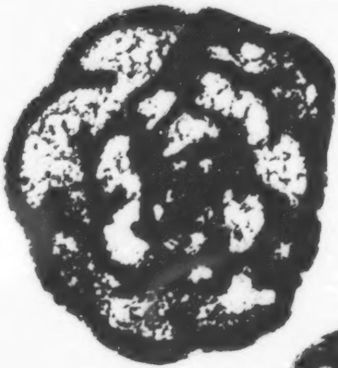
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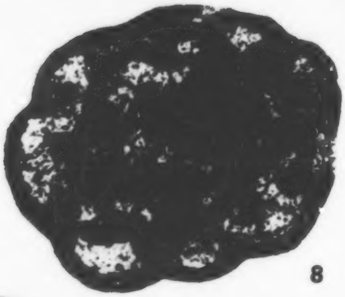
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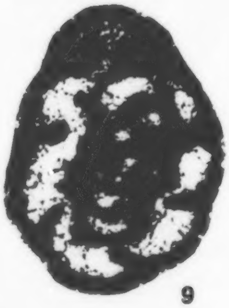
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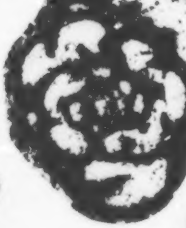
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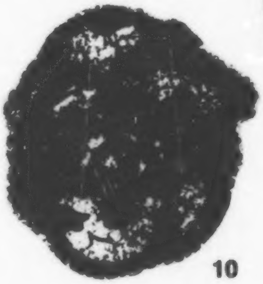
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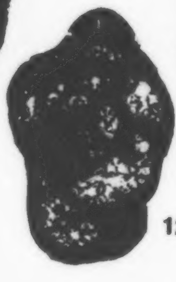
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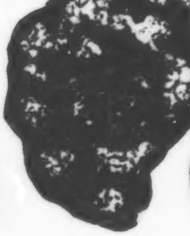
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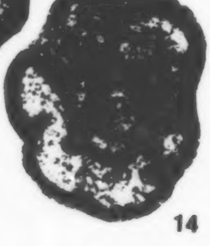
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PLATE 6

Figures 1-3. *Spinoendothyra recta* (Lipina) (page 18)

1. GSC 65758; GSC loc. C-39134; Mamet No. 424/29; Hook Creek Section, Mount Head(?) Formation, 14.3-17.1 m above base, Zone 11, early Viséan; x69.

2. GSC 65759; GSC loc. C-39183; Mamet No. 420/23; Mount Becker Section; Unnamed unit, 61.9-70.2 m above base, Zone 9/10 boundary, Tournaisian-Viséan transition; x69.

3. GSC 65760; GSC loc. C-39448; Mamet No. 426/16; East Fellers Creek Section, Shunda Formation, 104.9-111.0 m above base, Zone 9, late Tournaisian; x69.

Figures 4-7. *Spinoendothyra costifera* (Lipina in Grozdilova and Lebedeva) (page 18)

4. GSC 65761; GSC loc. C-39452; Mamet No. 425/14; East Fellers Creek Section, Turner Valley Formation, 0.3-2.7 m above base, basal Zone 10, earliest Viséan; x85.

5. GSC 65762; GSC loc. C-39448; Mamet No. 426/14; as for figure 3; x85.

6. GSC 65763; GSC loc. C-39291; Mamet No. 422/31; Belcourt Creek Section, Shunda Formation, 27.1-32.6 m above base, Zone 8/9 boundary, late Tournaisian; x85.

7. GSC 65764; GSC loc. C-39443; Mamet No. 426/6; East Fellers Creek Section, Shunda Formation, 72.6-77.5 m above base, Zone 9, late Tournaisian; x85.

Figure 8. "*Globoendothyra*" (?) *trachida* (Zeller) (page 19)

GSC 65765; GSC loc. C-39454; Mamet No. 427/1; East Fellers Creek Section, Turner Valley Formation, 11.6-19.5 m above base, Zone 10, early Viséan; x69.

Figures 9-13. "*Globoendothyra*" (?) *paratrachida* sp. nov. (page 20)

9. GSC 65766, paratype; GSC loc. C-39454; Mamet No. 424/4; as for figure 8; x69.

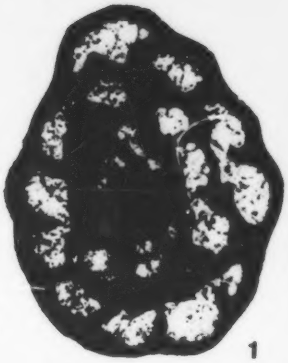
10. GSC 65767, paratype; GSC loc. C-39109; Mamet No. 423/8; Hook Creek Section, Shunda Formation, 64.6-72.6 m above base, Zone 9, late Tournaisian; x69.

11. GSC 65768, holotype; GSC loc. C-39454; Mamet No. 423/7; as for figure 8; x69.

12. GSC 65769, paratype; GSC loc. C-39454; Mamet No. 424/10; as for figure 8; x69.

13. GSC 65770, paratype; GSC loc. C-39454; Mamet No. 424/9; as for figure 8; x69.

PLATE 6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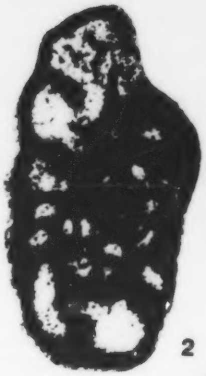
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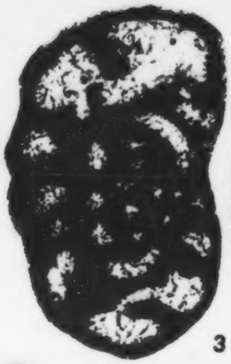
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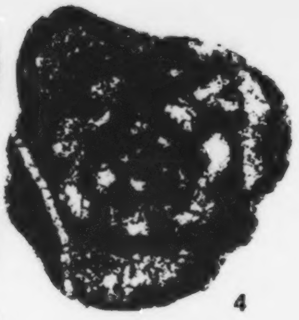
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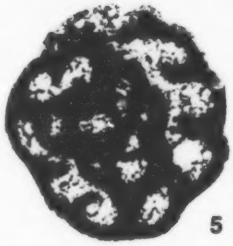
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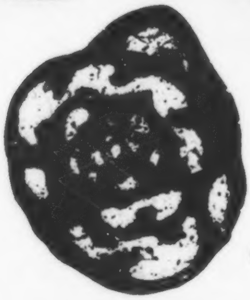
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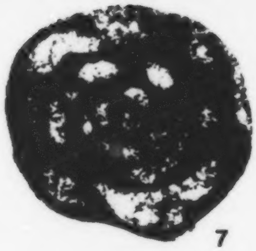
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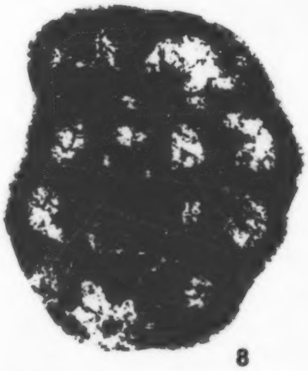
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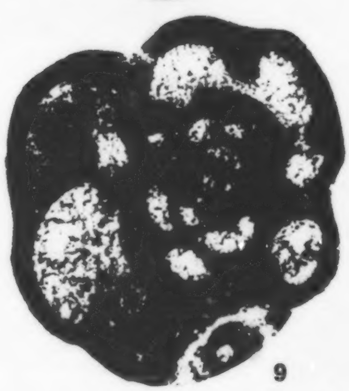
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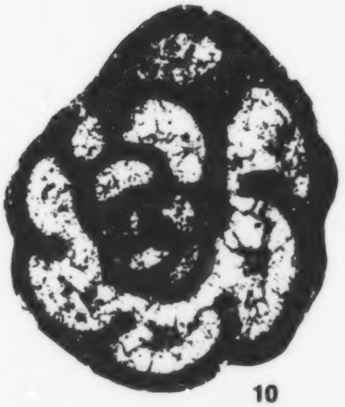
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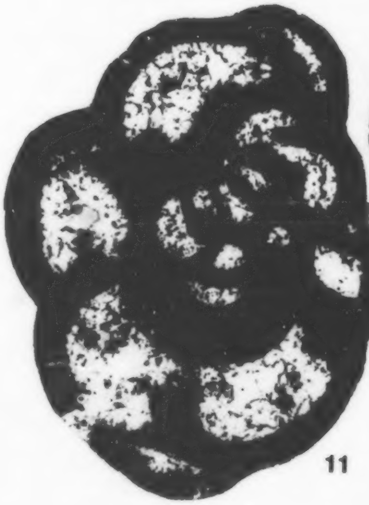
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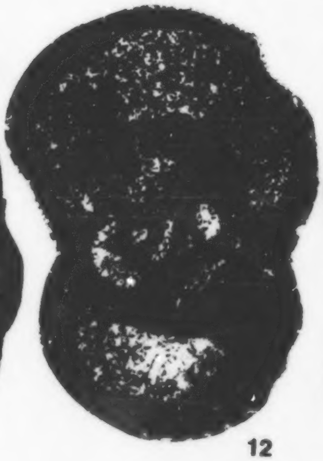
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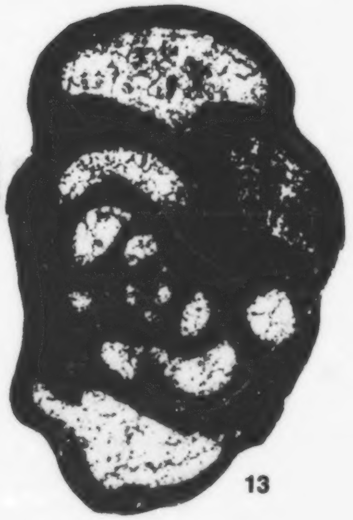
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PLATE 7

Figure 1. *Tuberendothyra tuberculata* (Lipina) (page 20)

GSC 65771; GSC loc. C-39291; Mamet No. 422/21; Belcourt Creek Section, Shunda Formation, 27.1-32.6 m above base, Zone 8/9 boundary, late Tournaisian; x69.

Figures 2-6. *Inflatoendothyra parainflata* (Bogush and Yuferev) (page 21)

2. GSC 65772; GSC loc. C-39464; Mamet No. 425/27; East Fellers Creek Section, Mount Head(?) Formation, 32.6-38.7 m above base, Zone 10, early Viséan; x85.

3. GSC 65773; GSC loc. C-39464; Mamet No. 425/23; as for figure 2; x85.

4. GSC 65774; GSC loc. C-39464; Mamet No. 425/24; as for figure 2; x85.

5. GSC 65775; GSC loc. C-39134; Mamet No. 424/27; Hook Creek Section, Mount Head(?) Formation, 14.3-17.1 m above base, Zone 11, early Viséan; x85.

6. GSC 65776; GSC loc. C-39132; Mamet No. 423/30; Hook Creek Section, Mount Head(?) Formation, 1.5-12.6 m above base, Zone 11(?), early Viséan; x69.

Figures 7, 8. *Paradainella dainelliformis* Brazhnikova and Vdovenko (page 22)

7. GSC 65777; GSC loc. C-39443; Mamet No. 426/5; East Fellers Creek Section, Shunda Formation, 72.6-77.5 m above base, Zone 9, late Tournaisian; x85.

8. GSC 65778; GSC loc. C-39468; Mamet No. 427/8; East Fellers Creek Section, Mount Head(?) Formation, 59.6-76.3 m above base, Zone 11, early Viséan, x85.

Figures 9-11. *Dainella cussyensis* (Meunier) (page 22)

9. GSC 65779; GSC loc. C-39469; Mamet No. 425/35; East Fellers Creek Section, Mount Head(?) Formation, 76.3-87.2 m above base, Zone 11, early Viséan; x54.

10. GSC 65780; GSC loc. C-39134; Mamet No. 424/18; as for figure 5; x69.

11. GSC 65781; GSC loc. C-39468; Mamet No. 427/16; as for figure 8; x69.

Figure 12. ?*Dainella cussyensis* (Meunier) (page 22)

GSC 65782; GSC loc. C-39469; Mamet No. 426/3; as for figure 9; x85.

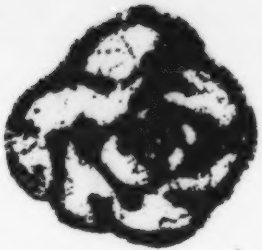
Figure 13. *Eoparastaffella simplex* Vdovenko (page 26)

GSC 65783; GSC loc. C-39198; Mamet No. 419/31; Mount Becker Section, Mount Head(?) Formation, 53.1-61.3 m above base, Zone 12, middle Viséan; x69.

Figure 14. *Dainella dainae* (Chernysheva) (page 23)

GSC 65784; GSC loc. C-39468; Mamet No. 423/34; as for figure 8; x54.

PLATE 7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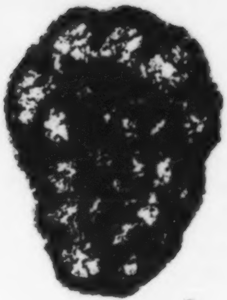
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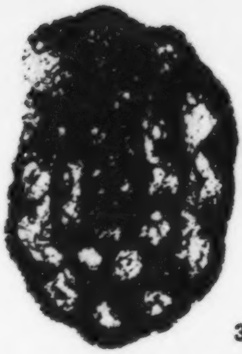
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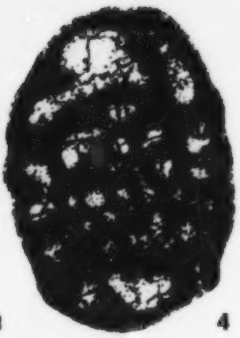
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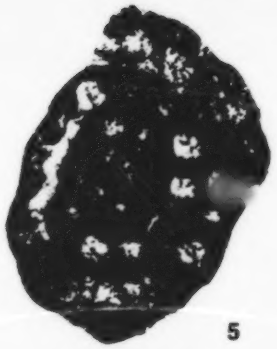
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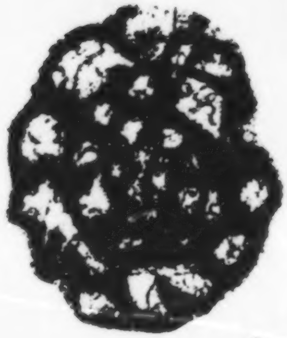
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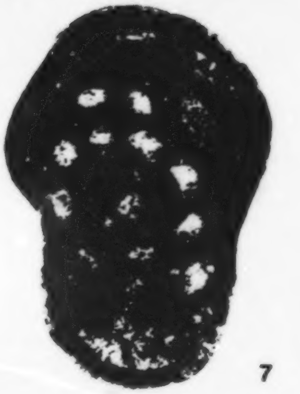
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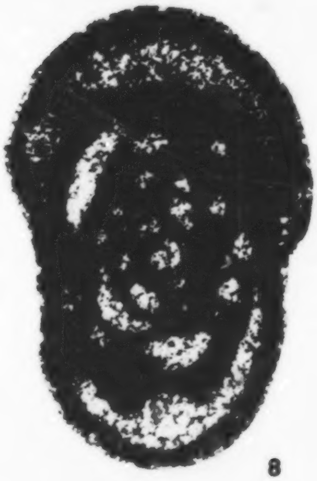
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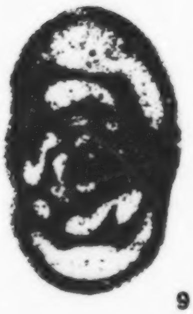
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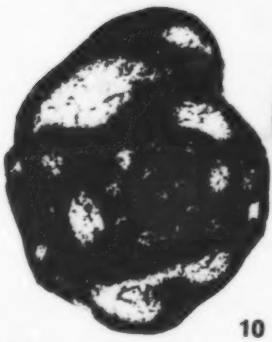
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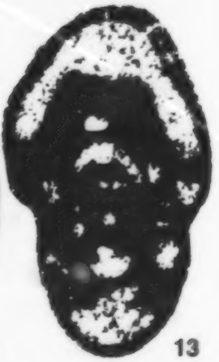
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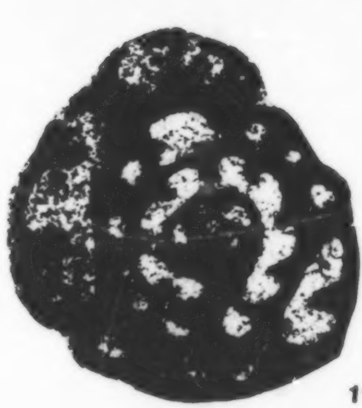
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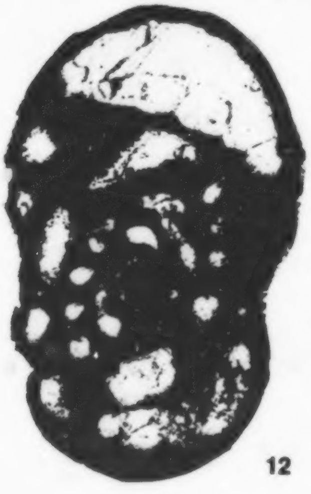
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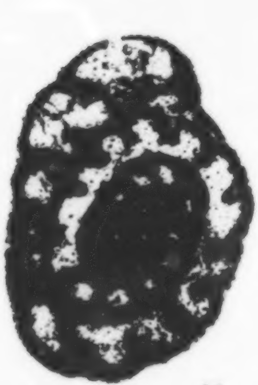
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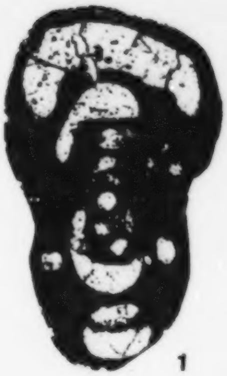
PLATE 8

Figures	1-9.	*Eoparastaffella ovalis* Vdovenko	(page 27)
	1.	GSC 65785; GSC loc. C-39198; Mamet No. 419/26; Mount Becker Section, Mount Head(?) Formation, 53.1-61.3 m above base, Zone 12, middle Viséan; x54.	
	2.	GSC 65786; GSC loc. C-39134; Mamet No. 424/32; Hook Creek Section, Mount Head(?) Formation, 14.3-17.1 m above base, Zone 11, early Viséan; x69.	
	3.	GSC 65787; GSC loc. C-39198; Mamet No. 421/22; as for figure 1; x85.	
	4.	GSC 65788; GSC loc. C-39198; Mamet No. 421/10; as for figure 1; x69.	
	5.	GSC 65789; GSC loc. C-39198; Mamet No. 421/7; as for figure 1; x69.	
	6.	GSC 65790; GSC loc. C-39468; Mamet No. 427/11; East Fellers Creek Section, Mount Head(?) Formation, 59.8-76.3 m above base, Zone 11, early Viséan; x69.	
	7.	GSC 65791; GSC loc. C-39198; Mamet No. 419/32; as for figure 1; x69.	
	8.	GSC 65792; GSC loc. C-39249; Mamet No. 421/26; Belcourt Creek Section, Mount Head(?) Formation, 49.4-53.4 m above base, Zone 11, early Viséan; x69.	
	9.	GSC 65793; GSC loc. C-39468; Mamet No. 427/13; as for figure 6; x69.	
Figures	10, 11.	*Eoendothyranopsis spiroides* (Zeller)	(page 28)
	10.	GSC 65794; GSC loc. C-39197; Mamet No. 419/22; Mount Becker Section, Mount Head(?) Formation, 31.1-39.0 m above base, Zone 11, middle Viséan; x69.	
	11.	GSC 65795; GSC loc. C-39134; Mamet No. 424/31; as for figure 2; x69.	
Figures	12, 13.	*Eoendothyranopsis hinduensis* (Skipp in McKee and Gutschick)	(page 28)
	12.	GSC 65796; GSC loc. C-39152; Mamet No. 429/12; 6 km southwest of East Fellers Creek Section, (54°42'30"N, 120°58'W), Mount Head(?) Formation, 0.0-6.1 m below top, Zone 11, middle Viséan; x26.	
	13.	GSC 65797; GSC loc. C-39198; Mamet No. 421/8; as for figure 1; x54.	

PLATE 8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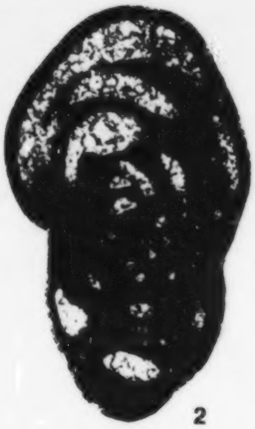
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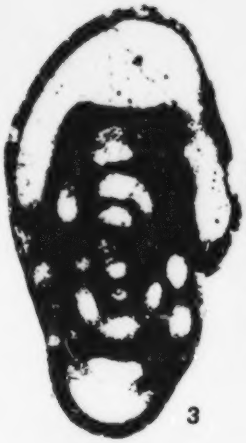
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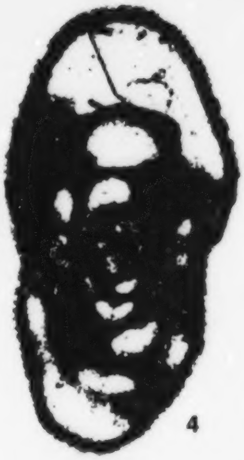
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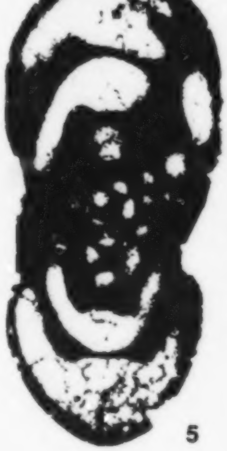
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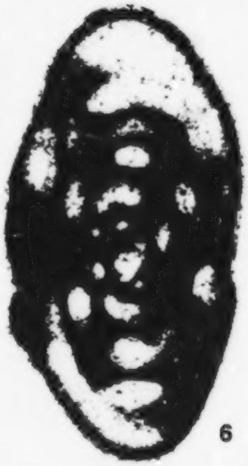
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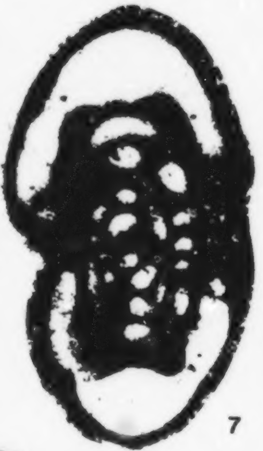
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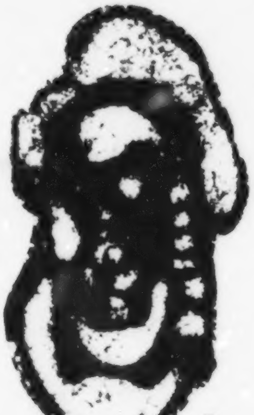
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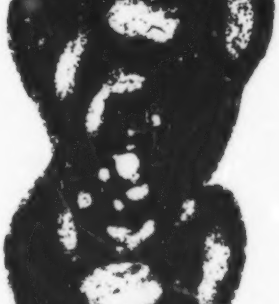
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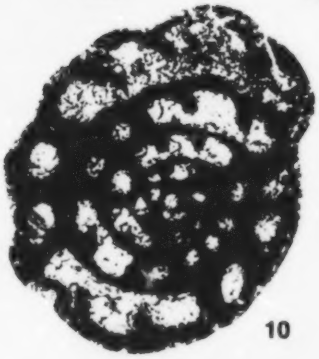
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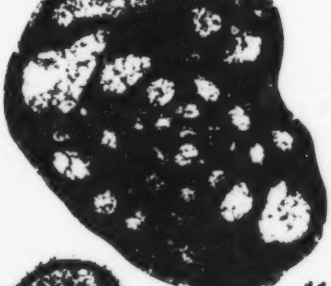
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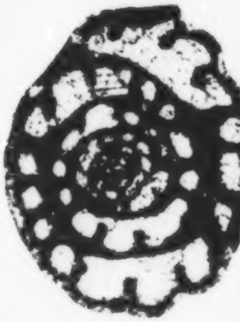
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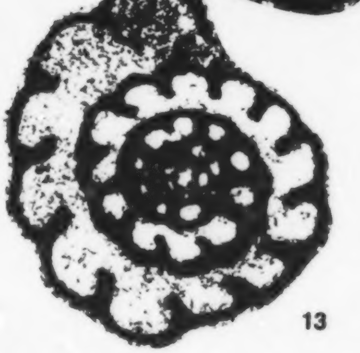
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PLATE 9

Figures 1-3 *Eoendothyranopsis hinduensis* (Skipp in McKee and Gutschick) (page 28)

1. GSC 65798; GSC loc. C-39198; Mamet No. 419/28; Mount Becker Section, Mount Head(?) Formation, 53.1-61.3 m above base, Zone 12, middle Viséan; x54.

2. GSC 65799; GSC loc. C-39198; Mamet No. 420/31; as for figure 1; x54.

3. GSC 65800; GSC loc. C-39132; Mamet No. 424/15; Hook Creek Section, Mount Head(?) Formation, 1.5-12.6 m above base, Zone 11, early Viséan; x54.

Figures 4-11. *Skippella fellersi* sp. nov. (page 25)

4. GSC 65801, paratype; GSC loc. C-39452; Mamet No. 426/33; East Fellers Creek Section, Turner Valley Formation, 0.3-2.7 m above base, Zone 10, earliest Viséan; x54.

5. GSC 65802, paratype; GSC loc. C-39452; Mamet No. 426/28; as for figure 4; x69.

6. GSC 65803, paratype; GSC loc. C-39452; Mamet No. 425/16; as for figure 4; x54.

7. GSC 65804, paratype; GSC loc. C-39452; Mamet No. 426/23; as for figure 4; x54.

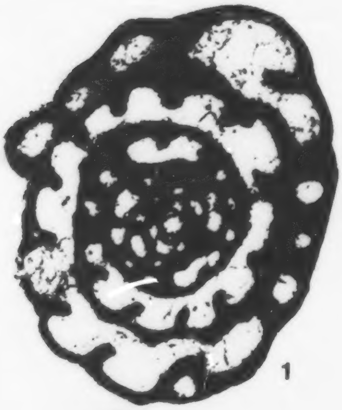
8. GSC 65805; paratype; GSC loc. C-39452; Mamet No. 426/34; as for figure 4; x54.

9. GSC 65806; paratype; GSC loc. C-39198; Mamet No. 421/11; as for figure 1; x69.

10. GSC 65807, paratype; GSC loc. C-39452; Mamet No. 430/7; as for figure 4; x54.

11. GSC 65808; paratype; GSC loc. C-39452; Mamet No. 426/26; as for figure 4; x54.

PLATE 9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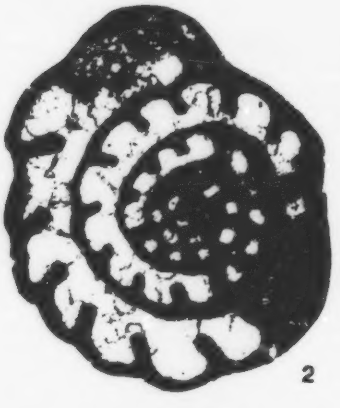
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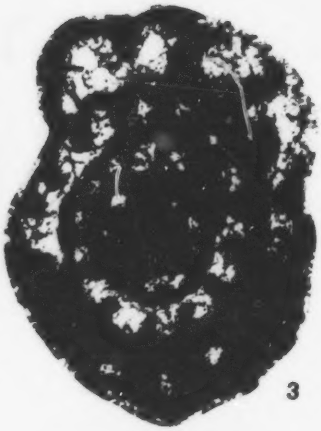
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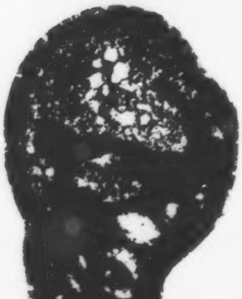
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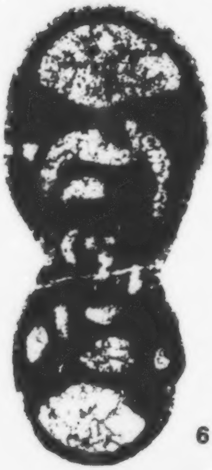
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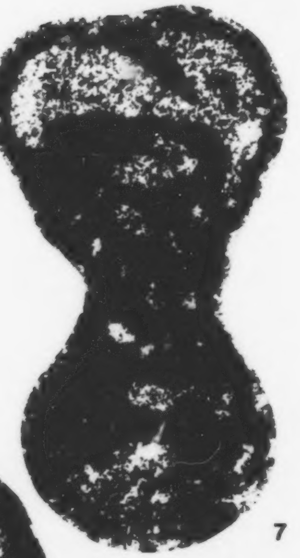
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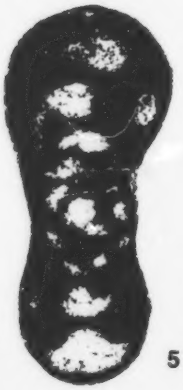
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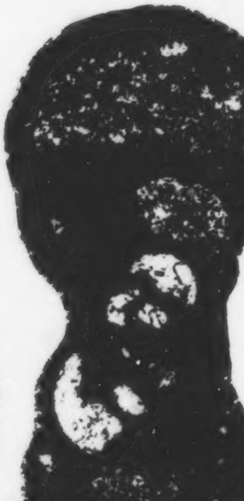
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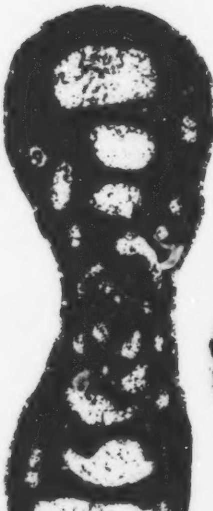
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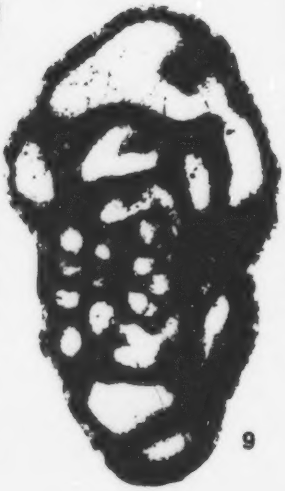
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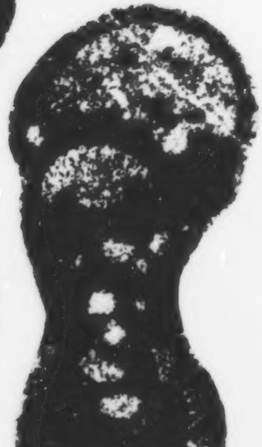
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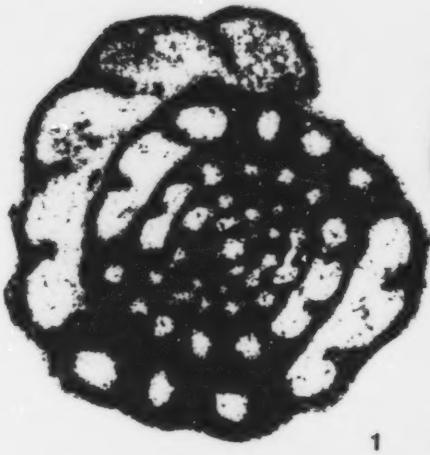
PLATE 10

Figure	1.	*Eoendothyranopsis hinduensis* (Skipp in McKee and Gutschick)	(page 28)
		GSC 65809; GSC loc. C-39468; Mamet No. 425/32; East Fellers Creek Section, Mount Head(?) Formation, 59.8-76.3 m above base, Zone 11, early Viséan; x69.	
Figures	2, 3.	*Skippella fellersi* sp. nov.	(page 25)
	2.	GSC 65810, holotype; GSC loc. C-39452; Mamet No. 425/15; East Fellers Creek Section, Turner Valley Formation, 0.3-2.7 m above base, basal Zone 10, earliest Viséan; x54.	
	3.	GSC 65811, paratype; GSC loc. C-39198; Mamet No. 421/13; Mount Becker Section, Mount Head(?) Formation, 53.1-61.3 m above base, Zone 12, middle Viséan; x69.	
Figure	4.	*Eblanaia michoti michoti* (Conil and Lys)	(page 25)
		GSC 65812; GSC loc. C-39198; Mamet No. 429/34; as for figure 2; x69.	
Figures	5-7.	*Eblanaia michoti spinata* (Michelsen)	(page 26)
	5.	GSC 65813; GSC loc. C-39452; Mamet No. 430/3; as for figure 2; x54.	
	6.	GSC 65814; GSC loc. C-39452; Mamet No. 429/22; as for figure 2; x54.	
	7.	GSC 65815; GSC loc. C-39452; Mamet No. 429/24; as for figure 2; x108.	
Figure	8.	*Globoendothyra* of the group *G. baileyi* (Hall)	(page 24)
		GSC 65816; GSC loc. C-39468; Mamet No. 427/21; as for figure 1; x69.	

PLATE 10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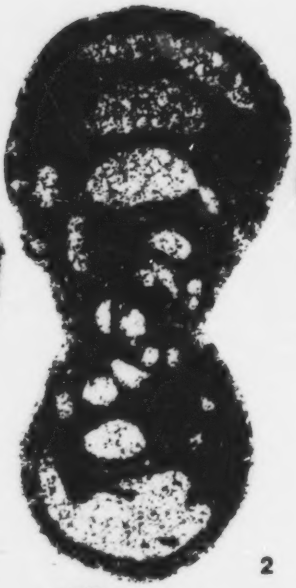
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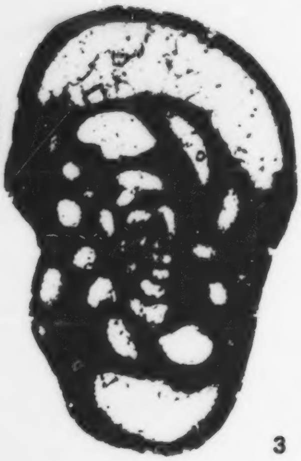
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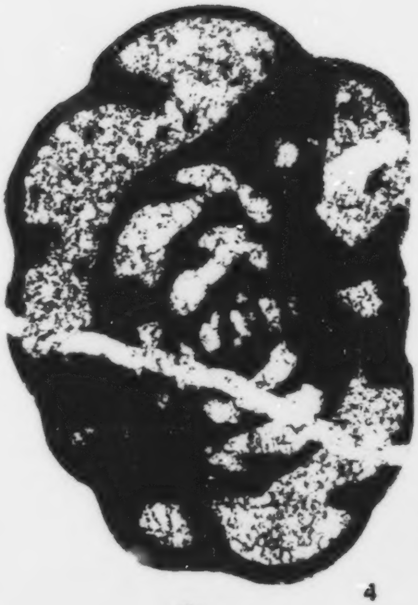
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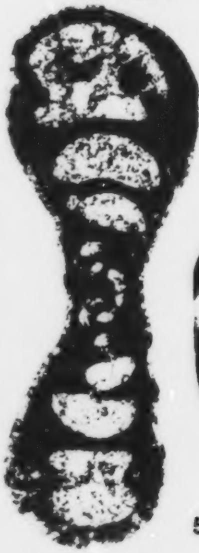
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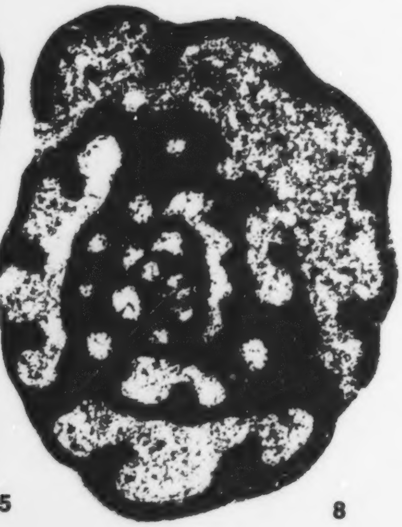
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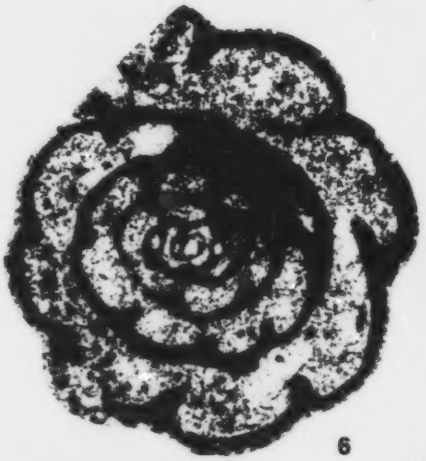
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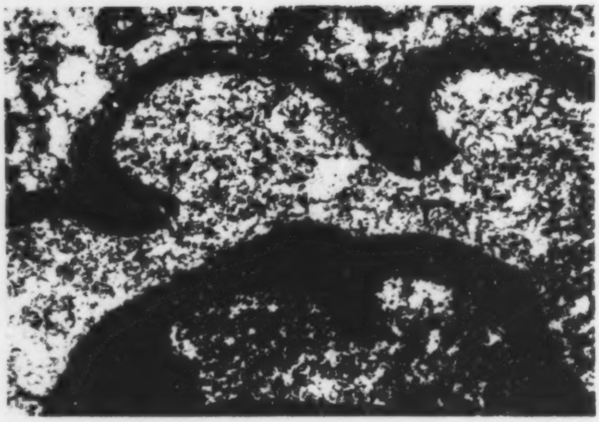


PLATE 11

Figures 1-7. *Globoendothyra* of the group *G. baileyi* (Hall) (page 24)

1. GSC 65817; GSC loc. C-39134; Mamet No. 423/32; Hook Creek Section, Mount Head(?) Formation, 14.3-17.1 m above base, Zone 11, early Viséan; x54.

2. GSC 65818; GSC loc. C-39468; Mamet No. 427/19; East Fellers Creek Section, Mount Head(?) Formation, 59.8-76.3 m above base, Zone 11, early Viséan; x54.

3. GSC 65819; GSC loc. C-39194; Mamet No. 420/29; Mount Becker Section, Mount Head(?) Formation, 31.1-39.0 m above base, Zone 11, early Viséan; x54.

4. GSC 65820; GSC loc. C-39198; Mamet No. 419/29; Mount Becker Section, Mount Head(?) Formation, 53.1-61.3 m above base, Zone 12, middle Viséan; x54.

5. GSC 65821; GSC loc. C-39198; Mamet No. 419/25; as for figure 4; x54.

6. GSC 65822; GSC loc. C-39468; Mamet No. 420/27; as for figure 2; x54.

7. GSC 65823; GSC loc. C-39468; Mamet No. 427/14; as for figure 2; x54.

Figure 8. *Skippella fellersi* sp. nov. (page 25)

GSC 65824, paratype; GSC loc. C-39468; Mamet No. 427/19; as for figure 2; x54.

Figure 9. *Eblanaia michoti michoti* (Conil and Lys) (page 25)

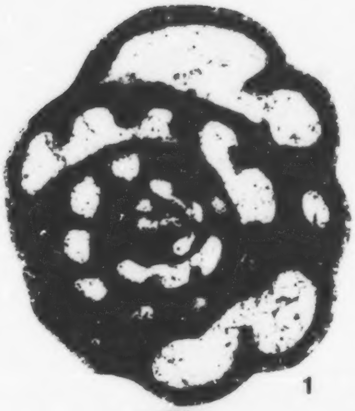
GSC 65825; GSC loc. C-39452; Mamet No. 429/25; East Fellers Creek Section, Turner Valley Formation, 0.3-2.7 m above base, basal Zone 10, earliest Viséan; x22.

Figures 10-12. *Globoendothyra paula* (Vissarionova) (page 24)

10. GSC 65826; GSC loc. C-39198; Mamet No. 421/6; as for figure 4; x54.

11. GSC 65827; GSC loc. C-39198; Mamet No. 421/4; as for figure 4; x54.

12. GSC 65828; GSC loc. C-39198; Mamet No. 421/14; as for figure 4; x54.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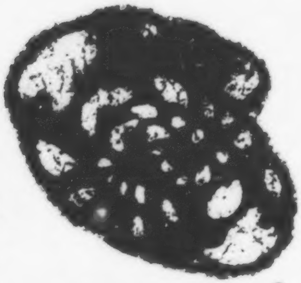
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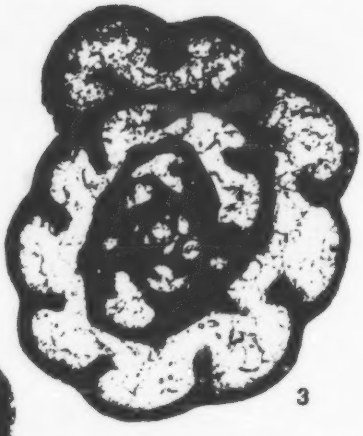
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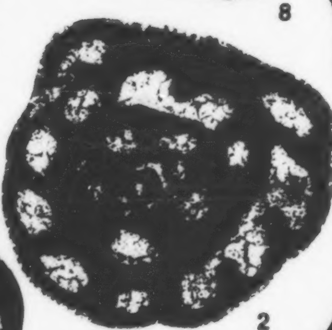
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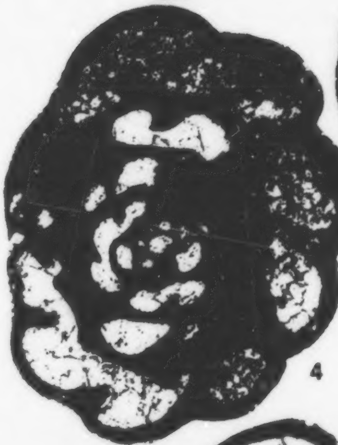
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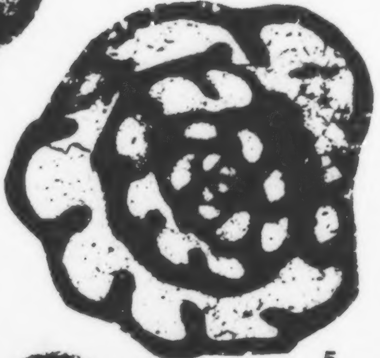
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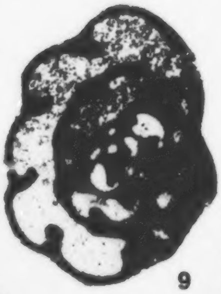
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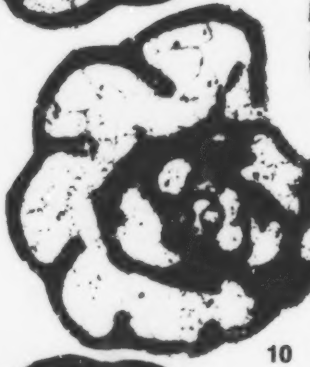
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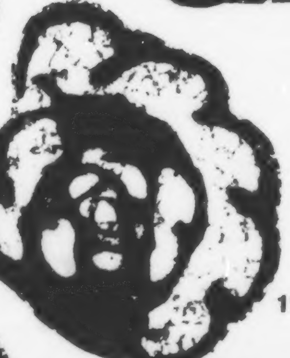
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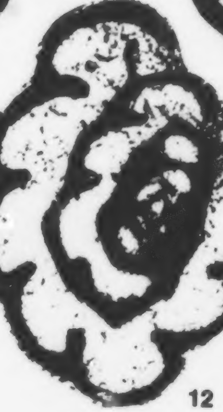
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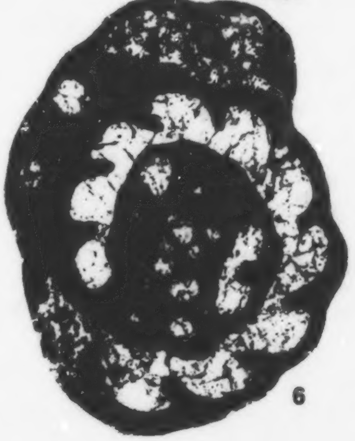
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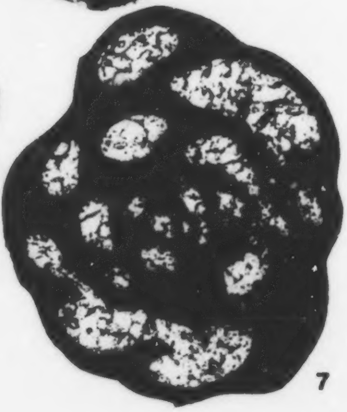
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PLATE 12

Figures 1, 2. *Orthriosiphon saskatchewanensis* Johnson and Konishi (page 28)

1. GSC 65829; GSC loc. C-39448; Mamet No. 426/19; East Fellers Creek Section, Shunda Formation, 104.9-111.0 m above base, Zone 9, late Tournaisian; x69.

2. GSC 65830; GSC loc. C-39443; Mamet No. 426/8; East Fellers Creek Section, Shunda Formation, 72.6-77.5 m above base, Zone 9, late Tournaisian; x69.

Figure 3. *Ortonella tyrrelensis* Mamet and Rudloff (page 29)

GSC 65831; GSC loc. C-39281; Mamet No. 422/6; Belcourt Creek Section, Shunda Formation, 80.5-92.1 m above base, Zone 9, late Tournaisian; x26.

Figures 4, 5. *Ortonella coloradoensis* Johnson (page 29)

4. GSC 65832; GSC loc. C-39281; Mamet No. 422/4; as for figure 3; x26.

5. GSC 65833; GSC loc. C-39436; Mamet No. 424/33; East Fellers Creek Section, Shunda Formation, 27.1-34.2 m above base, Zone 8/9, late Tournaisian; x22.

Figure 6. *Parachaetetes garwoodi* (Hinde in Garwood) (page 30)

GSC 65834; GSC loc. C-39445; Mamet No. 425/3; East Fellers Creek Section, Shunda Formation, 86.6-94.6 m above base, Zone 9, late Tournaisian; x26.

Figures 7, 8. *Kamaena itkillikensis* Mamet and Rudloff (page 29)

7. GSC 65835; GSC loc. C-39120; Mamet No. 423/28; Hook Creek Section, Shunda Formation, 138.2-144.3 m above base, Zone 9, late Tournaisian; x69.

8. GSC 65836; GSC loc. C-39164; Mamet No. 418/9; Mount Becker Section, Shunda Formation, 8.8-9.8 m above base, Zone 8, late Tournaisian; x85.

Figure 9. *Palaeoberesella lahuseni* (von Möller) (page 30)

GSC 65837; GSC loc. C-39160; Mamet No. 418/4; Mount Becker Section, Pekisko Formation, 24.4-30.5 m above base, Zone 8, late Tournaisian; x54.

Figure 10. *Pseudohedstroemia polyfurcata* Mamet and Roux (page 29)

GSC 65838; GSC loc. C-39281; Mamet No. 422/5; as for figure 3; x26.

Figure 11. *Pekiskopora* sp. (page 30)

GSC 65839; GSC loc. C-79574; Mamet No. 460/23; Mount Hanington North Section, Banff Formation, uppermost, upper Zone 7, middle Tournaisian; x85.

Figure 12. *Calcisphaera laevis* Williamson (page 31)

GSC 65840; GSC loc. C-39452; Mamet no. 430/13; East Fellers Creek Section, Turner Valley Formation, 0.3-2.7 m above base, basal Zone 10, earliest Viséan; x85.

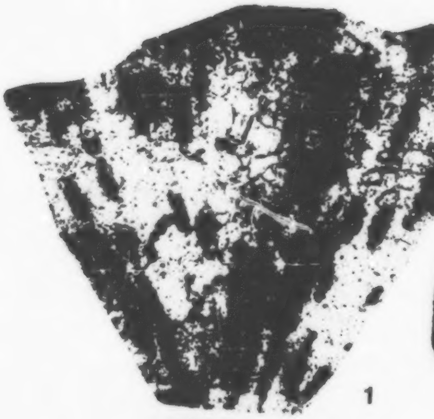
13. *Eovolutina tujmasensis* Lipina (page 31)

GSC 65841; GSC loc. C-39167; Mamet No. 420/9; Mount Becker Section, Shunda Formation, 22.9-28.1 m above base, Zone 8/9 boundary, late Tournaisian; x85.

Figure 14. *Turoholia* sp.

GSC 65842; GSC loc. C-39493; Mamet No. 421/16; Mount Becker Section, Banff Formation, 6.4-14.3 m below top, Zone 7, middle Tournaisian; x54.

PLATE 12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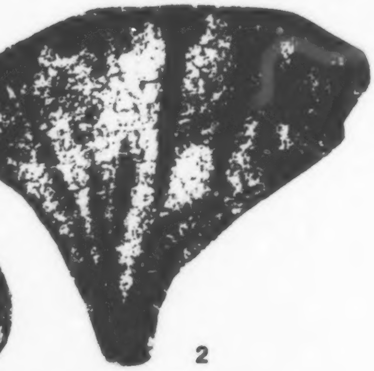
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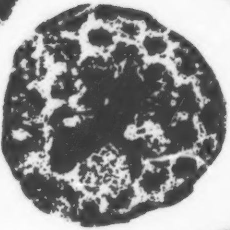
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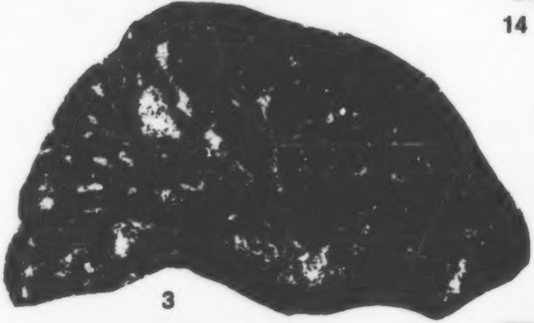
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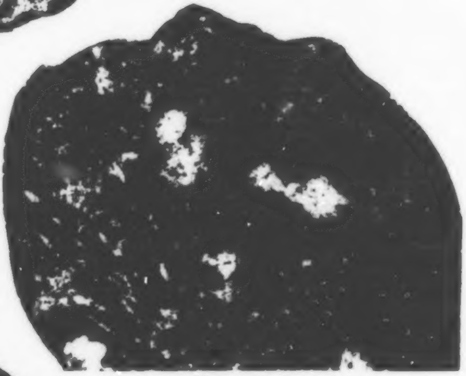
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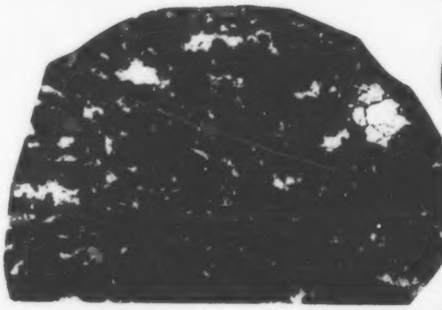
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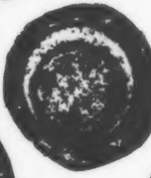
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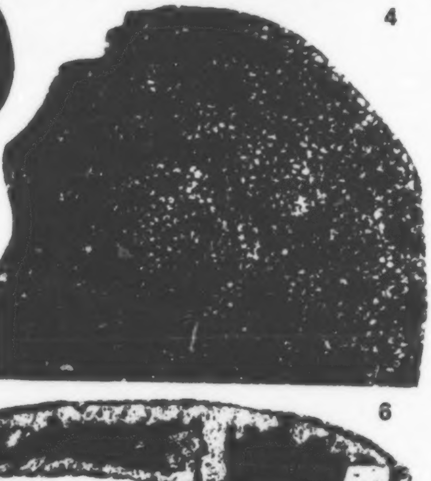
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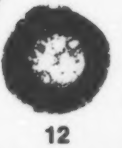
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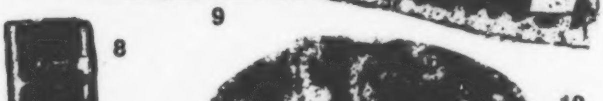
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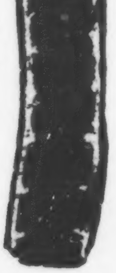
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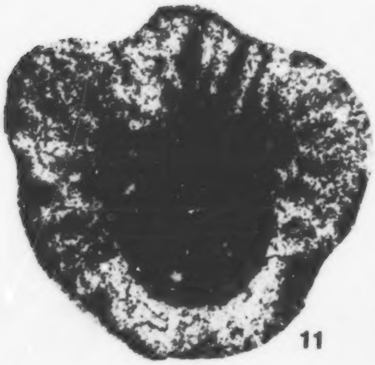
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PLATE 13

SHUNDA FORMATION

Figures 1, 2. GSC 65843; GSC loc. C-39291; Mamet No. 422/25, 422/27. Belcourt Creek Section, 27.1-32.6 m above base; Zone 8/9, late Tournaisian; x31. Alga-calcisphere-pellet wackestone-packstone. Peloid nature hidden by dark matrix. Abundant calcispheres and parathuramminids associated with *Issinella* sp. and *Proninella* sp. Thin, dissolved ostracodes. Some pelecypods. Bioturbation.

Figures 3, 4. GSC 65844; GSC loc. C-79592; Mamet No. 460/26, 427/33. Mount Hanington North Section, 10.4 m above base; Zone 8, late Tournaisian; x31. *Palaeoberesella-Issinella* packstone. A reworked, current oriented bafflestone formed by palaeoberesellids. Thalli are partially mud-filled. Facies excludes most other forms of microflora and microfauna. Scarce floated calcispheres and rare ostracode debris.

PLATE 13

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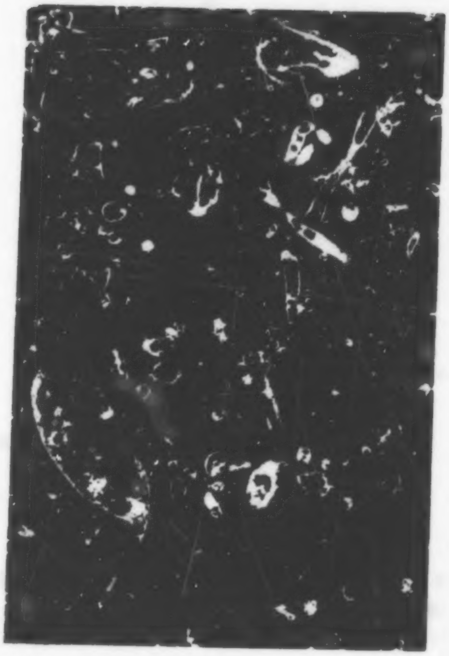

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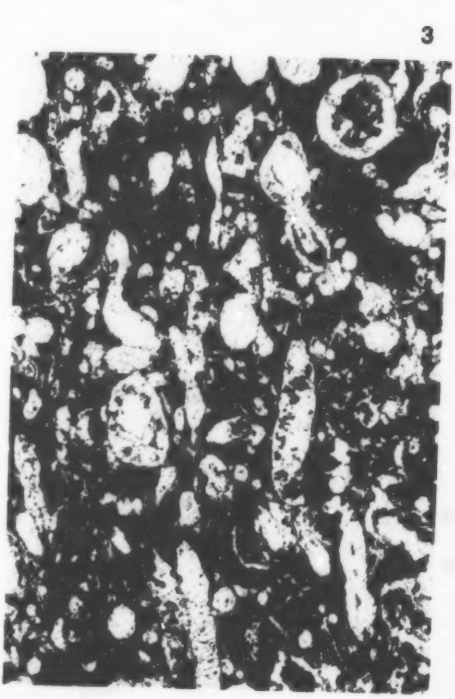

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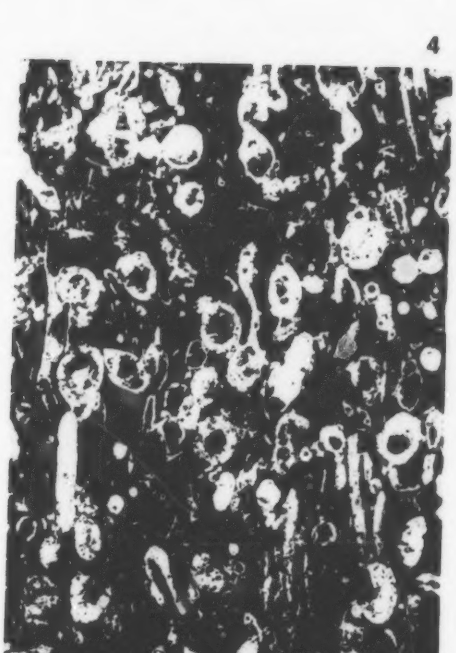

PLATE 14

SHUNDA FORMATION

Figure 1. GSC 65845; GSC loc. C-39291; Mamet No. 422/19; Belcourt Creek Section, 27.1-32.6 m above base, Zone 8/9, late Tournaisian; x54. Pelletoidal-algal packstone. Some pressure solution. Interpenetrating grains. Extensive recrystallization. *Tuberendothyra safonovae* Skipp in McKee and Gutschick, crushed Tournayellidae and *Palaeoberesella* sp.

Figure 2. GSC 65846; GSC loc. C39443; Mamet No. 425/13; East Fellers Creek Section, 72.6-77.5 m above base, Zone 9, late Tournaisian; x26. Dolomitic, pelletoidal wackestone with recrystallized *Spinoendothyra* sp.

Figure 3. GSC 65847; GSC loc. C-39167; Mamet No. 418/12; Mount Becker Section, 22.9-28.1 m above base, Zone 8/9 boundary, late Tournaisian. Recrystallized, poorly sorted wackestone grading to packstone. Echinoderms, pellets, Palaeoberesellid algae and foraminifers [*Tuberendothyra tuberculata* (Lipina) and *Spinoendothyra spinosa crassitheca* sp. nov.]

Figure 4. GSC 65848; GSC location same as figure 1; Mamet No. 419/34; 27.1-32.6 m above base. Recrystallized echinoderm-pellet packstone. Mud-filled *Spinoendothyra spinosa spinosa* (Chernysheva). Pressure solution. Stylolites.

PLATE 14

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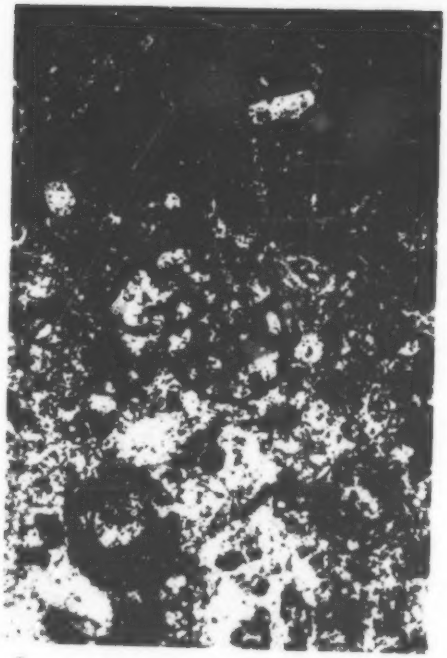
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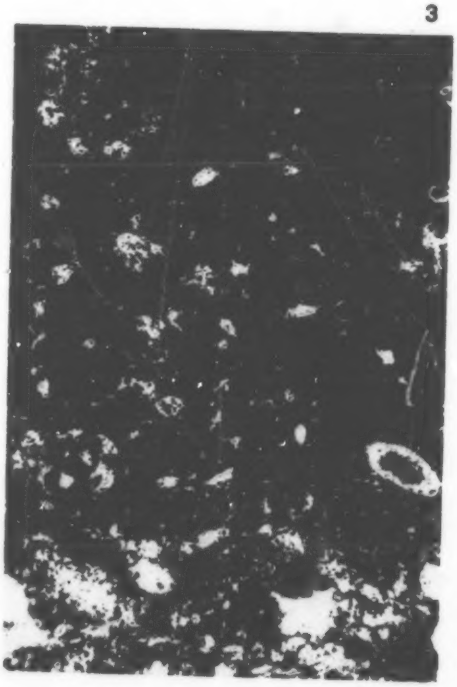
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PLATE 15

SHUNDA FORMATION

Figures 1-2. GSC 65849; GSC loc. C-39113; Mamet No. 423/17 and 423/18; Hook Creek Section, 90.0-97.0 m above base; Zone 9, late Tournaisian; x31. Algal-rich wackestone. The dark micritic groundmass conceals the pelletoidal nature. Heavy micritization of the calcispheres (*Calcisphaera* sp. and *Parathurammina* sp.). Algal thalli, dissolved, typically crumpled due to mud retraction: *Issinella* sp., *Kamaena* sp., and *Proninella* sp. Rare ostracodes.

Figures 3-4. GSC 65850; GSC loc. C-39119; Mamet No. 423/23 and 423/25; Hook Creek Section, 133.0-138.2 m above base; Zone 9, late Tournaisian; x31. Wackestone littered with calcispheres. All degrees of micritization, from a thin calcitic veneer to heavy, dark, thick envelopes around the spines of parathuramminids: *Calcisphaera laevis* Williamson; *Parathurammina* of the group *P. spinosa* (Williamson), *Parathurammina* of the group *P. suleimanovi* Lipina, *Parathurammina* of the group *P. dagmarae* Suleimanov, etc. Dissolved, crumpled algal thalli; *Issinella* sp., *Kamaena* sp., and *Proninella* sp. Some ostracodes and pellets.

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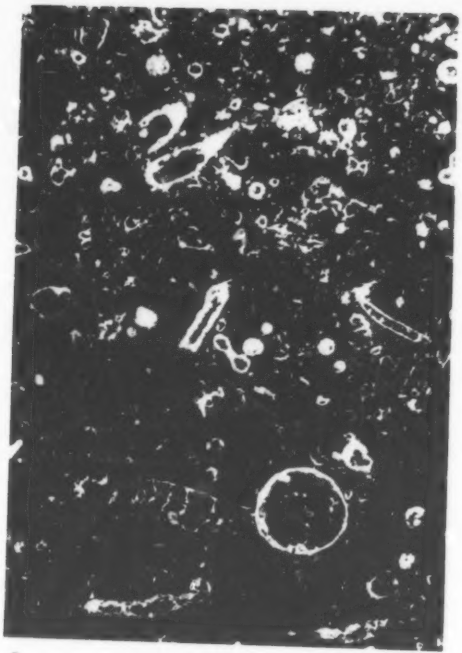

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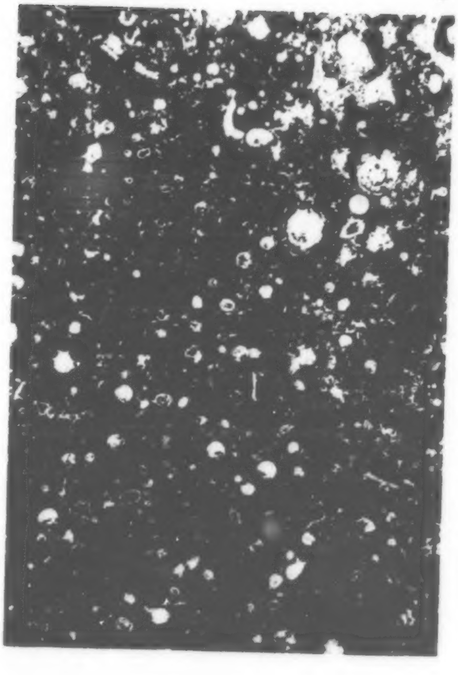

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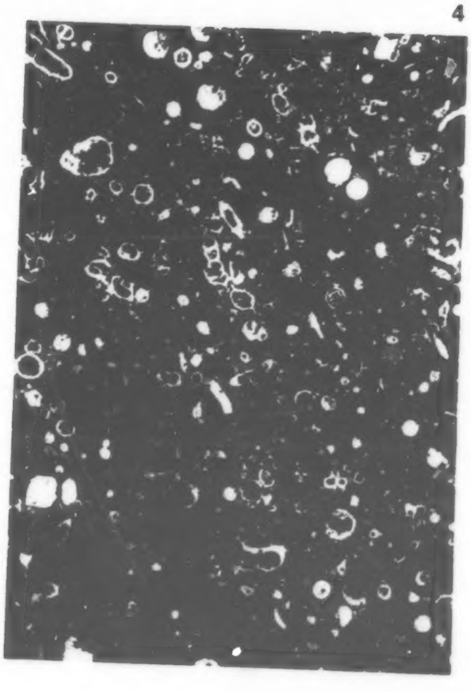


PLATE 16

MOUNT HEAD(?) FORMATION

Figure 1. GSC 65851; GSC loc. C-39249; Mamet No. 421/23; Belcourt Creek Section, 49.4-53.4 m above base, Zone 11, early Viséan; x28. Hydrozoan encrusting a mollusc. Host rock is a dolomitic fossil-pellet packstone. Note the well preserved, composite, prismatic structure.

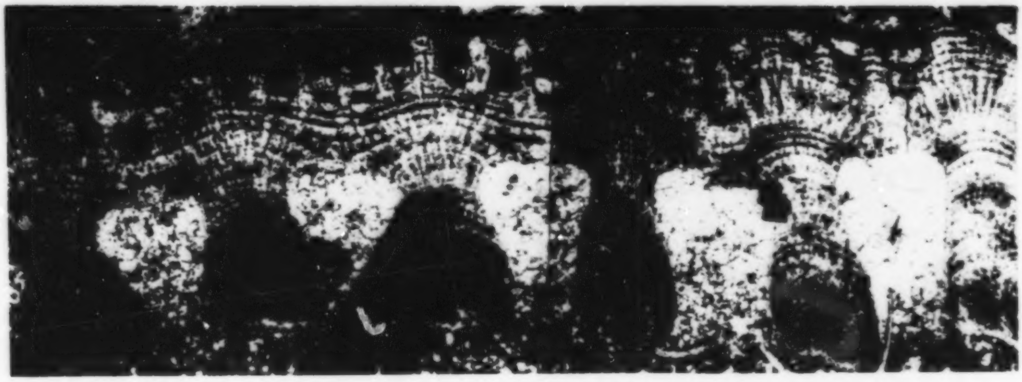
TURNER VALLEY FORMATION

Figure 2. GSC 65852; GSC loc. C-39452; Mamet No. 429/25; East Fellers Creek Section, 0.3-2.7 m above base, basal Zone 10, earliest Viséan; x28. A slightly recrystallized, poorly sorted, fossil packstone. An example of mixture of residual Tournaisian spinoendothyrids with the earliest Viséan *Eblanaia*. (*E. michoti michoti* Conil and Lys).

MOUNT HEAD(?) FORMATION

Figures 3, 4. GSC 65853; GSC loc. C-39198; Mamet Nos. 419/24 and 419/27; Mount Becker Section, 53.1-61.3 m above base, Zone 12, middle Viséan; x28. Poorly sorted, slightly dolomitic foraminiferal packstone. Echinoderm plates, pelecypods, algae. Foraminifers are ***Eoendothyranopsis hinduensis*** Skipp in McKee and Gutschick, ***Globoendothyra*** of the group ***G. baileyi*** (Hall), ***Globoendothyra*** sp., and ***Skippella redwallensis*** (Skipp in McKee and Gutschick).

PLATE 16



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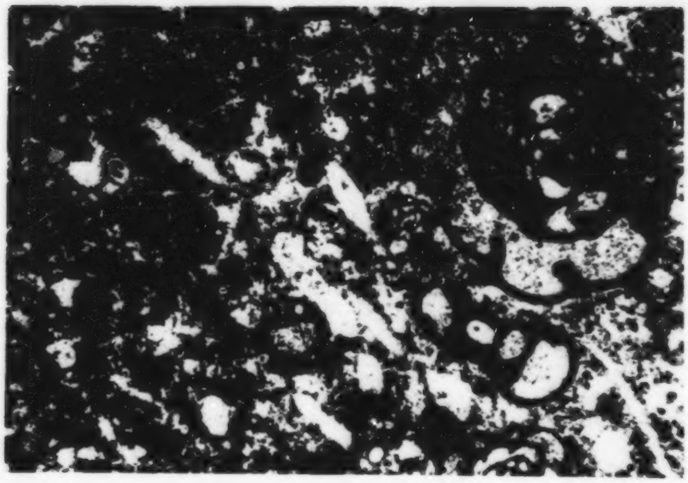

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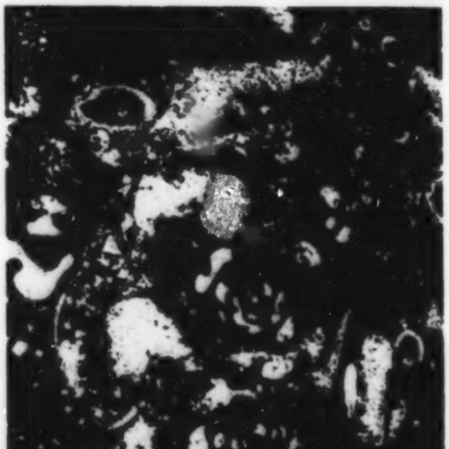

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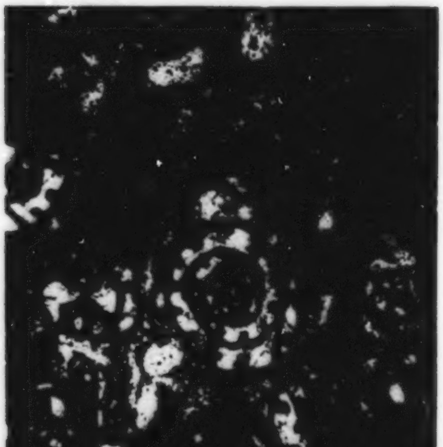


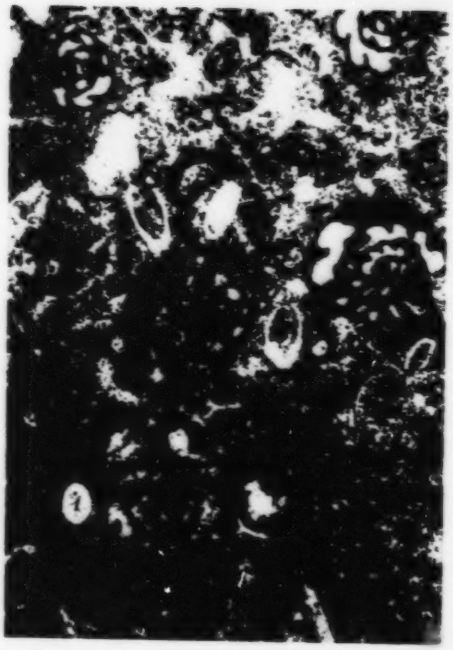
PLATE 17

MOUNT HEAD(?) FORMATION

Figures 1-3. GSC 65854; GSC loc. C-39194; Mamet No. 419/15, 419/16 and 420/30; Mount Becker Section, 31.1-39.0 m above base, Zone 11, early Viséan; x31. Slightly dolomitic (recrystallized microspar), poorly sorted foraminiferal wackestone-packstone. Foraminiferal test preservation ranges from completely recrystallized to perfect: ***Earlandia clavatula*** (Howchin), ***Eoendothyranopsis hinduensis*** (Skipp in McKee and Gutschick), ***Skippella*** sp., ***Globoendothyra*** of the group ***G. baileyi*** (Hall), ***Eblanaia*** sp., ***Priscella*** sp. Algae are mostly ***Issinella*** sp. Weathered echinoid spines. Ostracodes.

Figure 4. GSC 65855; GSC loc. C-39198; Mamet No. 421/2; Mount Becker Section, 53.1-61.3 m above base, Zone 12, middle Viséan; x31. Slightly dolomitic (recrystallized microspar, some dolomite rhombs), poorly sorted, foraminiferal packstone. Weathered echinoderm plates. Ostracodes. Algae are ***Issinella*** sp. Foraminifers are ***Eoforschia*** of the group ***E. moelleri*** (Malakhova in Dain), ***Skippella redwallensis*** (Skipp in McKee and Gutschick), ***Globoendothyra*** of the group ***G. tomiliensis*** (***Globoendothyra paula*** Vissariona), and others.

PLATE 17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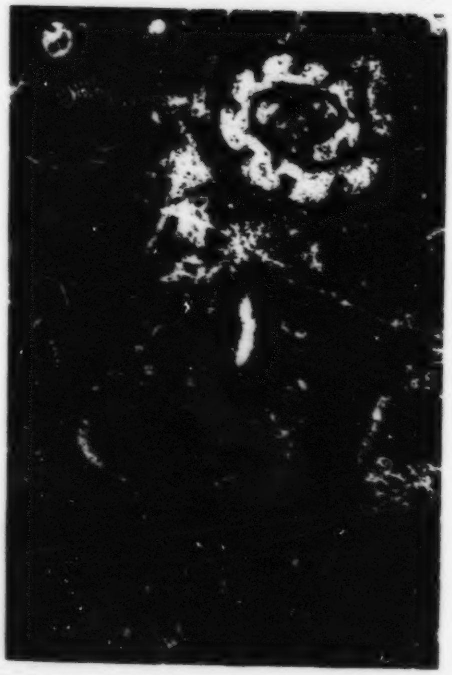

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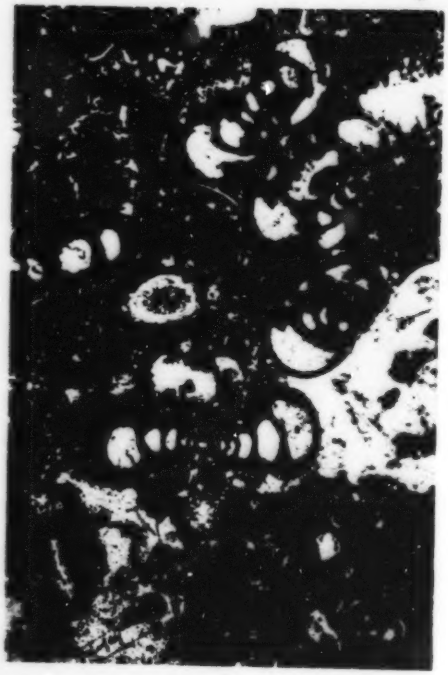


PLATE 18

MOUNT HEAD(?) FORMATION

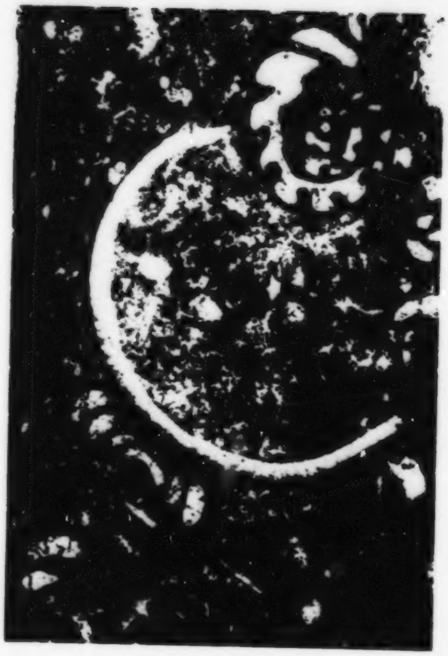
Figure 1. GSC 65856; GSC loc. C-39134; Mamet No. 423/36; Hook Creek Section, 14.3-17.1 m above base, Zone 11, early Viséan; x31. Poorly sorted fossil wackestone. Pelecypods, ostracodes, sponge micro- and mega-sclerites, foraminifers: a typical *Eblanaia-Eoforschia* assemblage.

Figure 2. GSC 65857; GSC loc. C-39134; Mamet No. 423/35; Hook Creek Section, 14.3-17.1 m above base, Zone 11, early Viséan; x31. An exceptional case of good preservation due to chertification of a fossil wackestone (same facies as in figure 1). Silica probably derived from sponge spicules. Foraminifers are *Eblanaia* sp. and *Eoendothyranopsis* of the group *E. spiroides* (*Eoendothyranopsis hinduensis* Skipp in McKee and Gutschick). The diaphanotheca is still recognizable in the endothyranopsid.

Figure 3. GSC 65858; GSC loc. C-39468; Mamet No. 427/17; East Fellers Creek Section, 59.8-76.3 m above base, Zone 11, early Viséan; x31. Recrystallized fossil-pellet packstone. Weathered echinoderms, calcispheres (calcisphaerids, parathuramminids, radiosphaerids), mud-coated grains, lumps and foraminifers: *Earlandia* sp., *Eoforschia* sp., *Skippella* sp., *Eoendothyranopsis* sp., *Globoendothyra* sp., etc.

Figure 4. GSC 65859; GSC loc. C-39469; Mamet No. 426/1; East Fellers Creek Section, 76.3-87.2 m above base, Zone 11(?), early Viséan; x31. A recrystallized fossil packstone. Mud-coated, partly dissolved pelecypod fragments. Mud-coated grains. Ghosts of recrystallized pellets. Some cement. Foraminifers are *Eoendothyranopsis* of the group *E. spiroides* (*Eoendothyranopsis hinduensis* Skipp in McKee and Gutschick) and globoendothyrids.

PLATE 18



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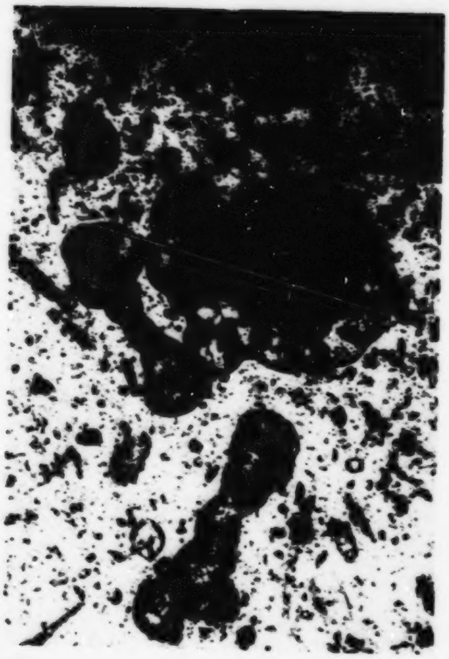

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3

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GEOLOGICAL SURVEY OF CANADA COMMISSION GÉOLOGIQUE DU CANADA

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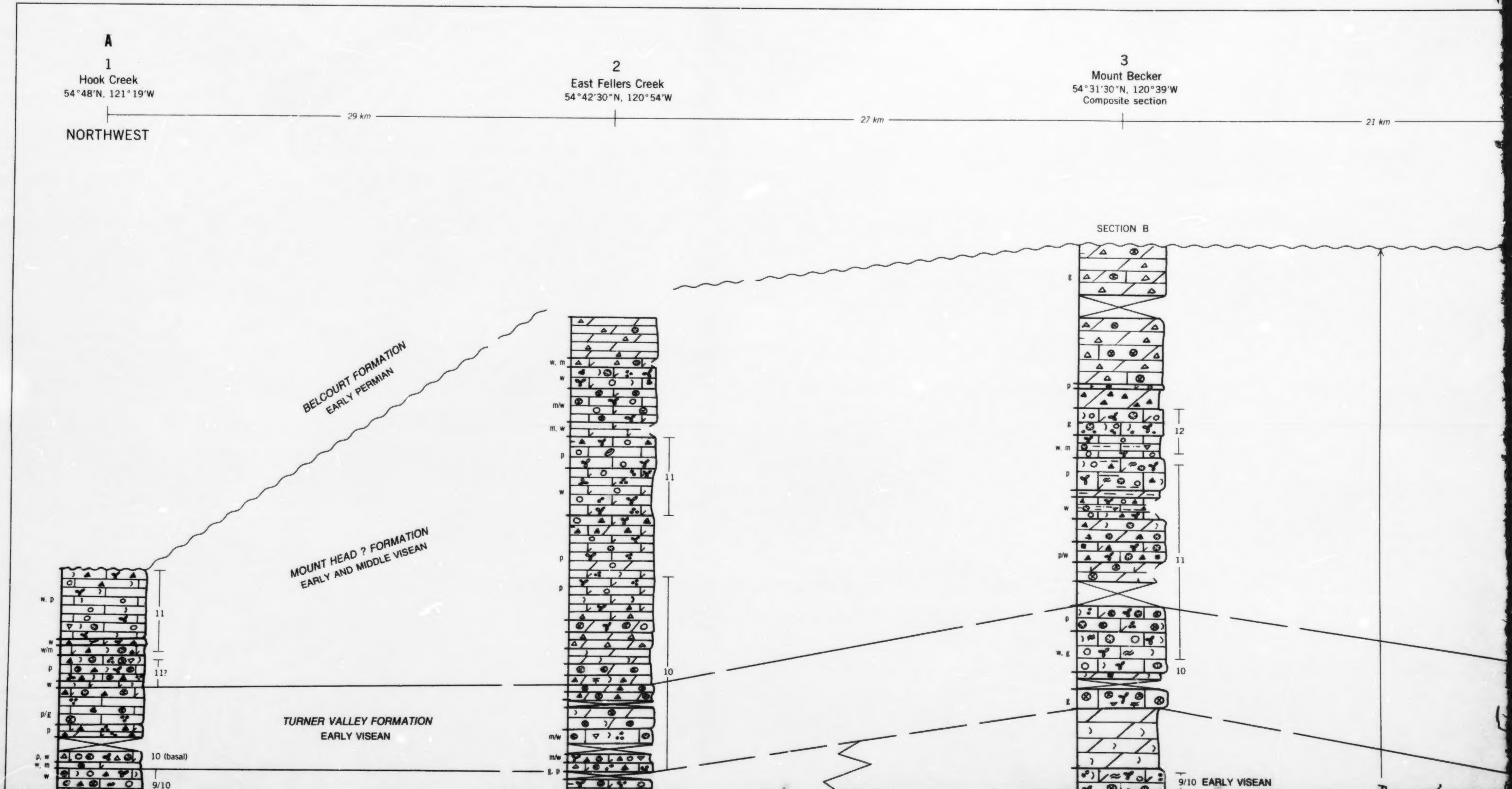
A
1
Hook Creek
54°48'N, 121°19'W
NORTHWEST
29 km
2
East Fellers Creek
54°42'30"N, 120°54'W
27 km
3
Mount Becker
54°31'30"N, 120°39'W
Composite section
21 km
SECTION B
BELCOURT FORMATION
EARLY PERMIAN
MOUNT HEAD ? FORMATION
EARLY AND MIDDLE VISEAN
TURNER VALLEY FORMATION
EARLY VISEAN
w, p
w
w/m
p
w
p/g
p
p, w
w, m
w
11
11?
10 (basal)
9/10
w, m
w
m/w
m, w
p
w
p
p
m/w
m/w
g, p
11
10
g
p
g
w, m
p
w
p/w
p
w, g
g
12
11
10
9/10 EARLY VISEAN

GEOLOGICAL SURVEY OF CANADA

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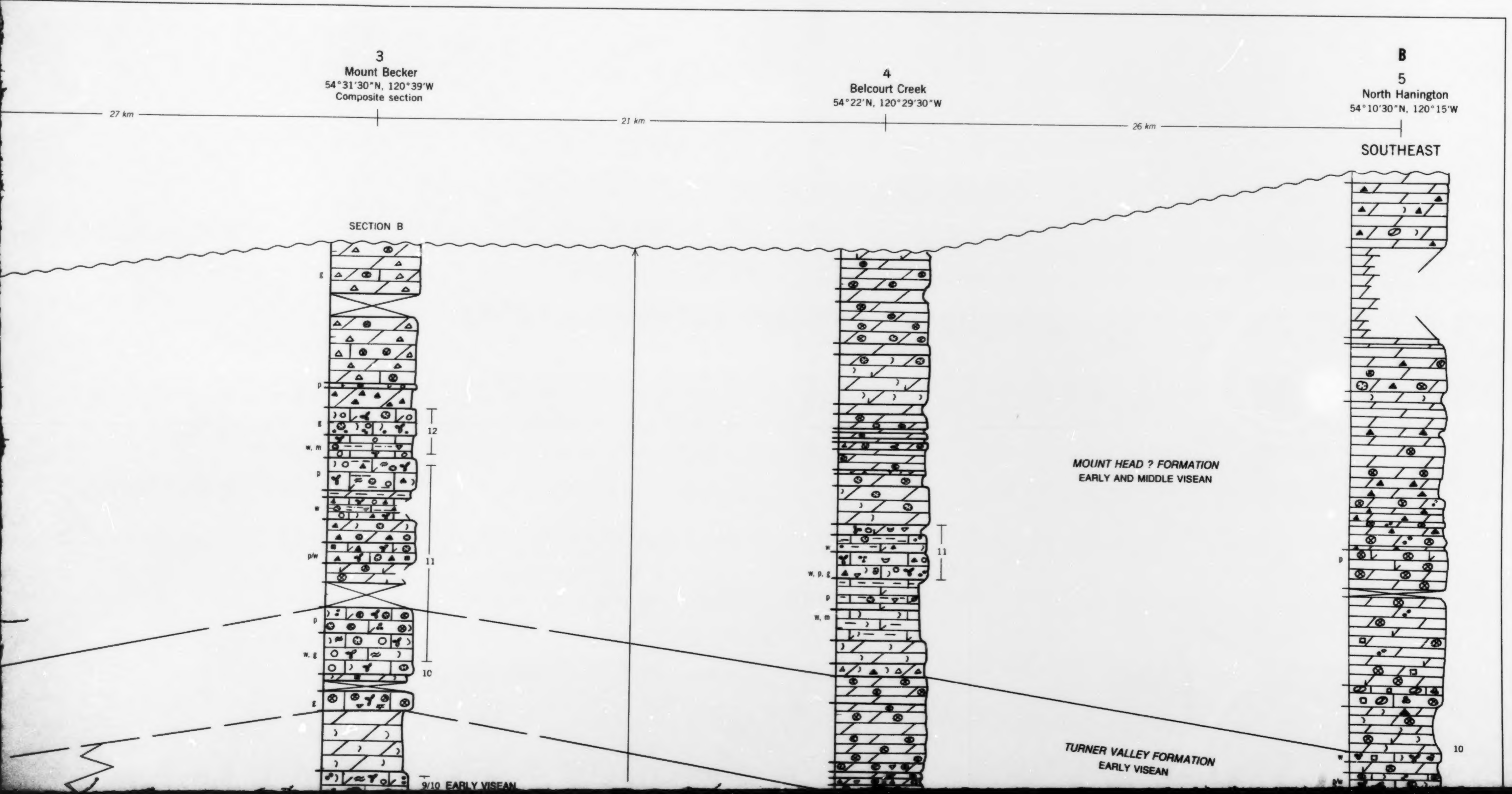
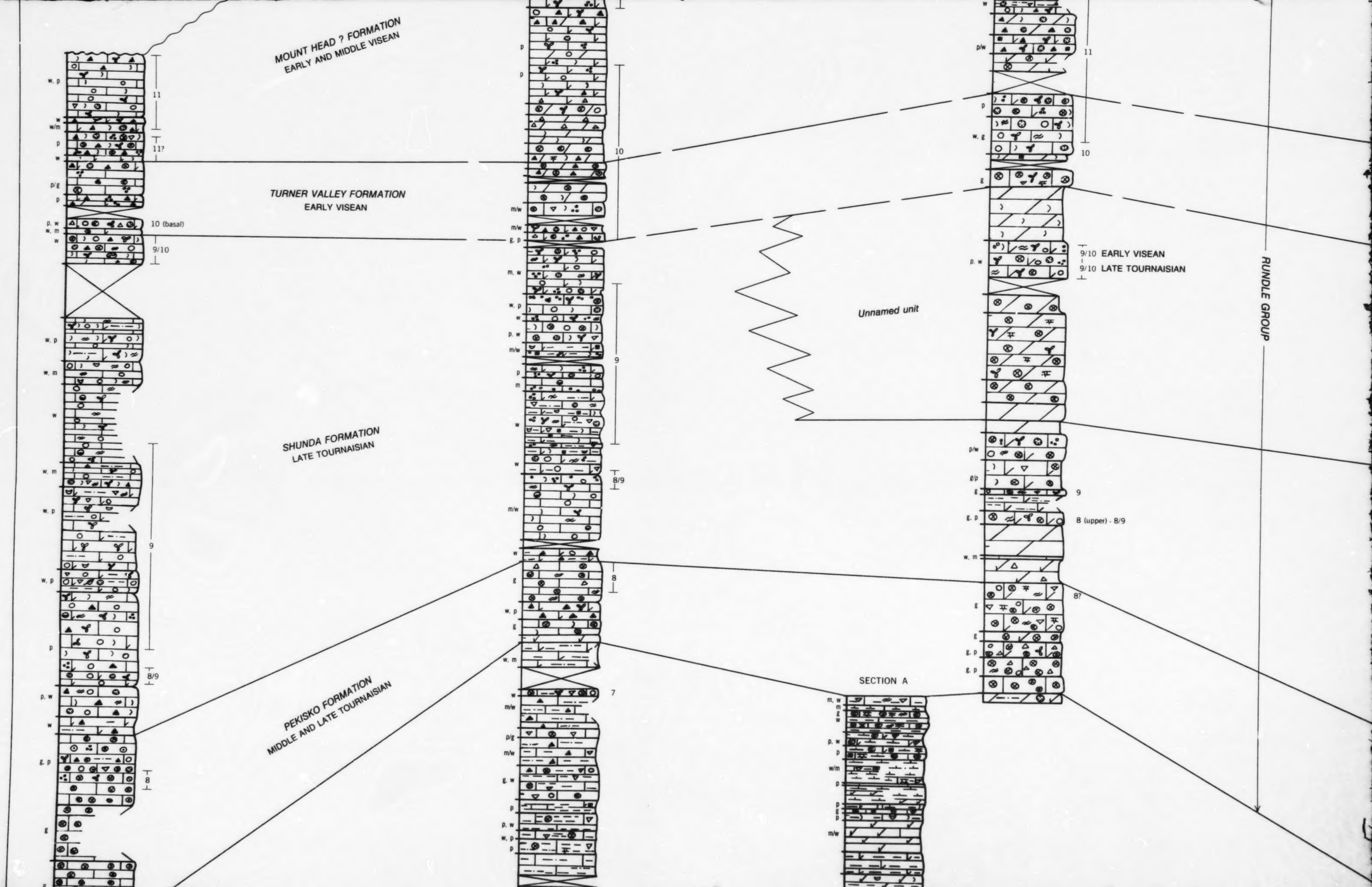
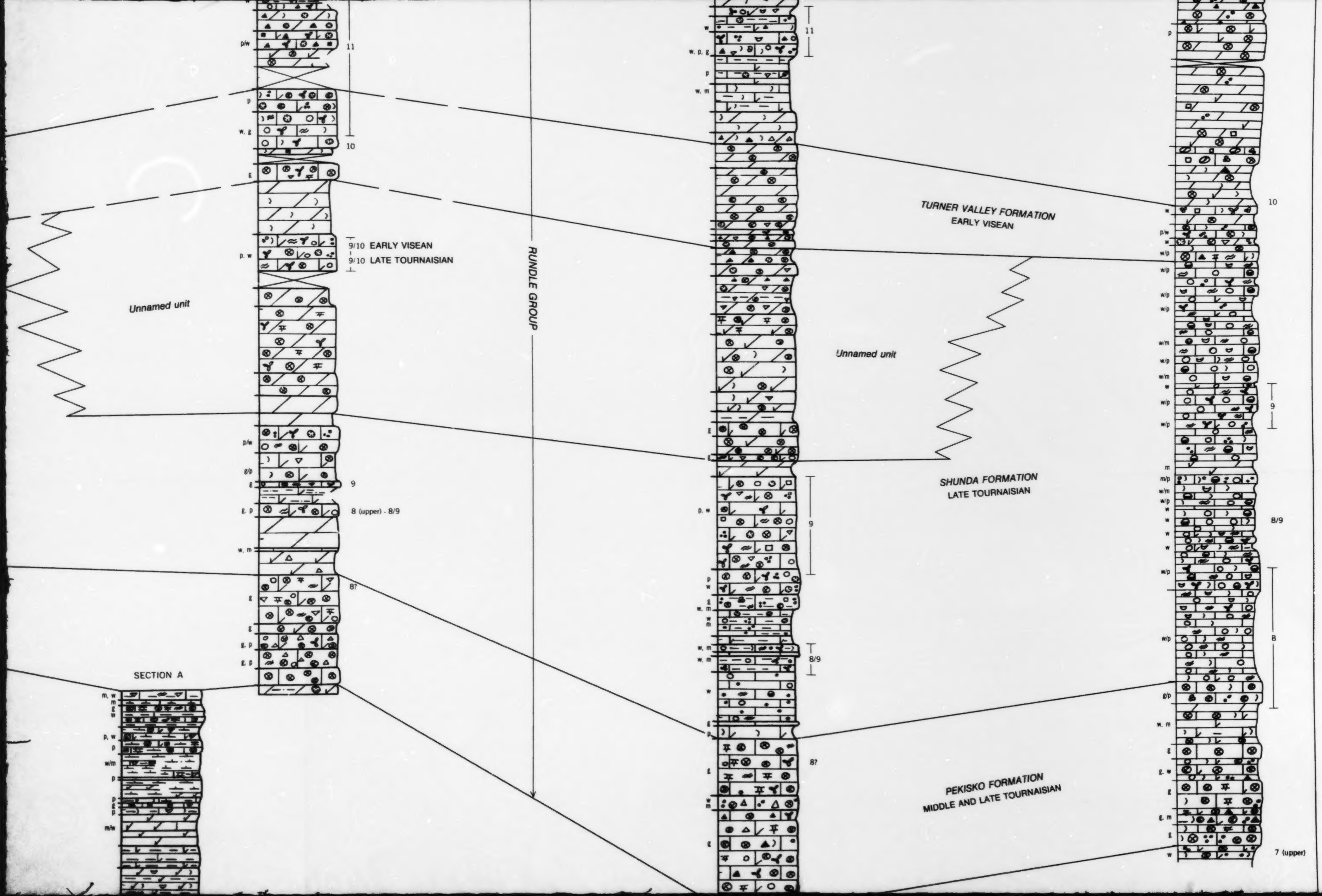
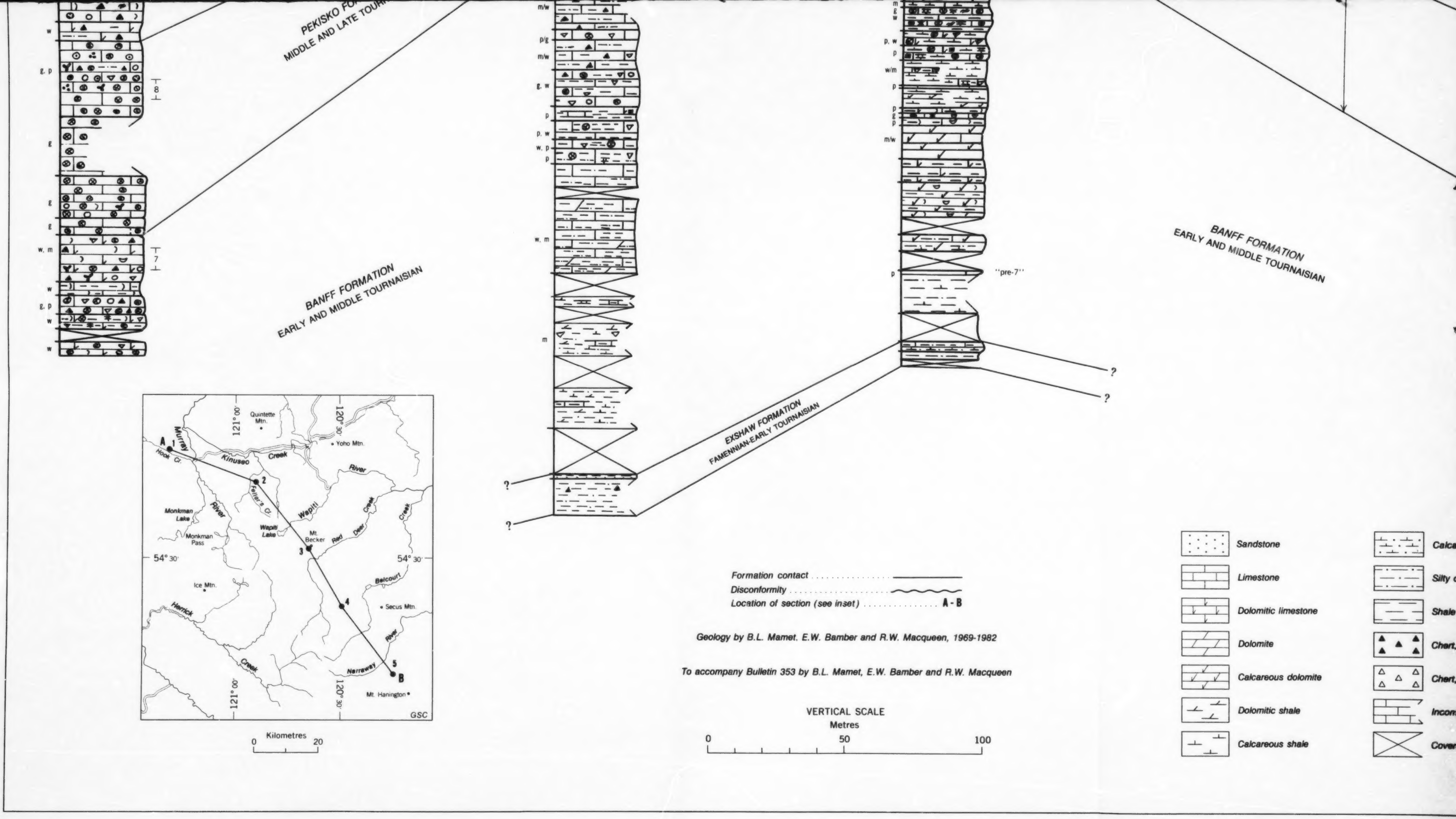

B
3
Mount Becker
54°31'30"N, 120°39'W
Composite section
4
Belcourt Creek
54°22'N, 120°29'30"W
5
North Hanington
54°10'30"N, 120°15'W
27 km
21 km
26 km
SOUTHEAST
SECTION B
g
p
g
w, m
p
w
p/w
p
w, g
g
12
11
10
9/10 EARLY VISEAN
w
w, p, g
p
w, m
11
MOUNT HEAD ? FORMATION
EARLY AND MIDDLE VISEAN
TURNER VALLEY FORMATION
EARLY VISEAN
p
w
p/w
10


MOUNT HEAD ? FORMATION
EARLY AND MIDDLE VISEAN
TURNER VALLEY FORMATION
EARLY VISEAN
SHUNDA FORMATION
LATE TOURNAISIAN
PEKISKO FORMATION
MIDDLE AND LATE TOURNAISIAN
Unnamed unit
SECTION A
RUNDLE GROUP
11
11?
10 (basal)
9/10
9
8/9
8
10
7
9/10 EARLY VISEAN
9/10 LATE TOURNAISIAN
8 (upper) - 8/9
8?

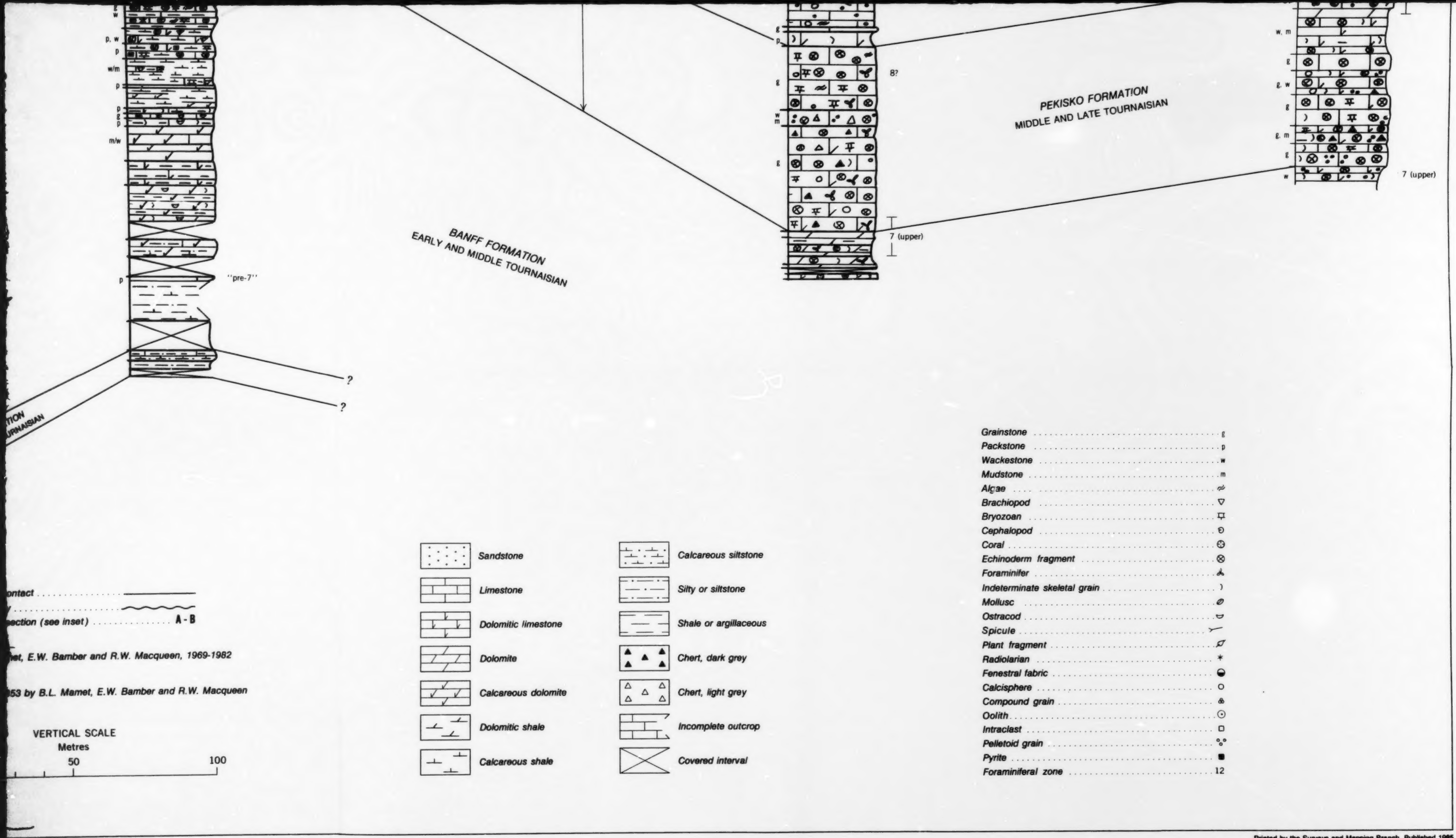

11
10
9/10 EARLY VISEAN
9/10 LATE TOURNAISIAN
Unnamed unit
RUNDLE GROUP
9
8 (upper) - 8/9
8?
SECTION A
11
9
8/9
8?
TURNER VALLEY FORMATION
EARLY VISEAN
Unnamed unit
SHUNDA FORMATION
LATE TOURNAISIAN
PEKISKO FORMATION
MIDDLE AND LATE TOURNAISIAN
10
9
8/9
8
7 (upper)


PEKISKO FO
MIDDLE AND LATE TOUR
BANFF FORMATION
EARLY AND MIDDLE TOURNAISIAN
8
7
EXSHAW FORMATION
FAMENNIAN-EARLY TOURNAISIAN
"pre-7"
BANFF FORMATION
EARLY AND MIDDLE TOURNAISIAN
?
?
?
?
Quintette Mtn.
121° 00'
120° 30'
Yoho Mtn.
A
1
Murray
Hook Cr.
Kinuseo
Creek
River
2
Teller's Cr.
Wapiti
Monkman Lake
River
Monkman Pass
Wapiti Lake
Mt. Becker
Red
Deer
Creek
Creek
3
54° 30'
54° 30'
Ice Mtn.
4
Belcourt
Secus Mtn.
Herrick
River
Creek
Narraway
5
B
Mt. Hanington
GSC
Kilometres
0
20
Formation contact
Disconformity
Location of section (see inset)
A - B
VERTICAL SCALE
Metres
0
50
100
Sandstone
Limestone
Dolomitic limestone
Dolomite
Calcareous dolomite
Dolomitic shale
Calcareous shale
Calca
Silty c
Shale
Chert,
Chert,
Incon
Cover

Geology by B.L. Mamet, E.W. Bamber and R.W. Macqueen, 1969-1982

To accompany Bulletin 353 by B.L. Mamet, E.W. Bamber and R.W. Macqueen

Figure 3. Northwest-southeast reconstructed cross-section, Lower Carboniferous,
Pass area, northeastern British Columbia (not palinspastically restored)


p, w
p
w/m
p
p
g
p
m/w
p
"pre-7"
?
?
TION
URNAISIAN
BANFF FORMATION
EARLY AND MIDDLE TOURNAISIAN
g
p
g
w
m
g
8?
7 (upper)
PEKISKO FORMATION
MIDDLE AND LATE TOURNAISIAN
w, m
g
g, w
g
g, m
g
w
7 (upper)
ontact
ection (see inset) A - B
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353 by B.L. Mamet, E.W. Bamber and R.W. Macqueen
VERTICAL SCALE
Metres
50
100
Sandstone
Limestone
Dolomitic limestone
Dolomite
Calcareous dolomite
Dolomitic shale
Calcareous shale
Calcareous siltstone
Silty or siltstone
Shale or argillaceous
Chert, dark grey
Chert, light grey
Incomplete outcrop
Covered interval
Grainstone g
Packstone p
Wackestone w
Mudstone m
Algae
Brachiopod
Bryozoan
Cephalopod
Coral
Echinoderm fragment
Foraminifer
Indeterminate skeletal grain
Mollusc
Ostracod
Spicule
Plant fragment
Radiolarian
Fenestral fabric
Calcisphere
Compound grain
Oolith
Intraclast
Pelletoid grain
Pyrite
Foraminiferal zone 12

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west-southeast reconstructed cross-section, Lower Carboniferous, Monkman area, northeastern British Columbia (not palinspastically restored).

FIGURE 3
GSC Bulletin 353